Engineering and Mining Journal

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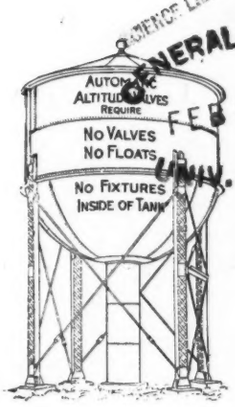

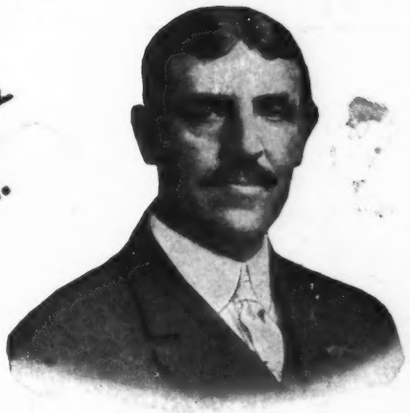

CHARLES E. GOLDEN
President and General Manager

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You can stop this waste in a simple, certain and practical way by equipping your supply mains with

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1. Automatically control the inflow of water to maintain the required level in reservoirs, stand-pipes, open tanks, etc.

2. Entirely self-contained. No floats or fixtures are required either inside or outside of the tanks.

3. Cushioned by water and air. No pounding, water hammer, surges or shock. No metal-to-metal seating.

4. Can be closed three ways: Automatically when the water pressure increases—By electricity from distant points—and by hand if desired.

5. Easily connected to also work "both ways" on a single pipe-line; also to close automatically the instant that the pipe bursts.

6. Extra strong in construction. Practically indestructible.

7. Globe or angle type. Sizes to 24 in.

GOLDEN-ANDERSON

Patent Automatic Cushioned Controlling Float Valves

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3. Will operate on as low as ½ to ¾ in. variation in water level.

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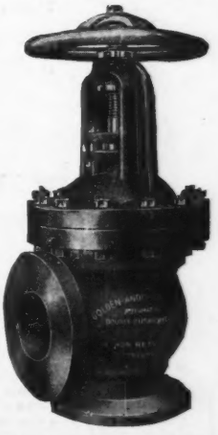

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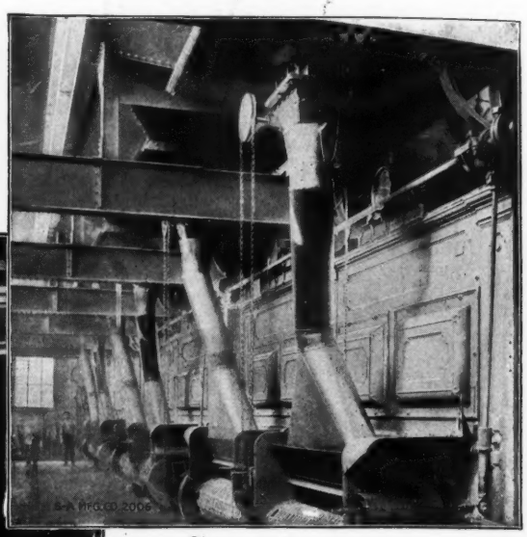

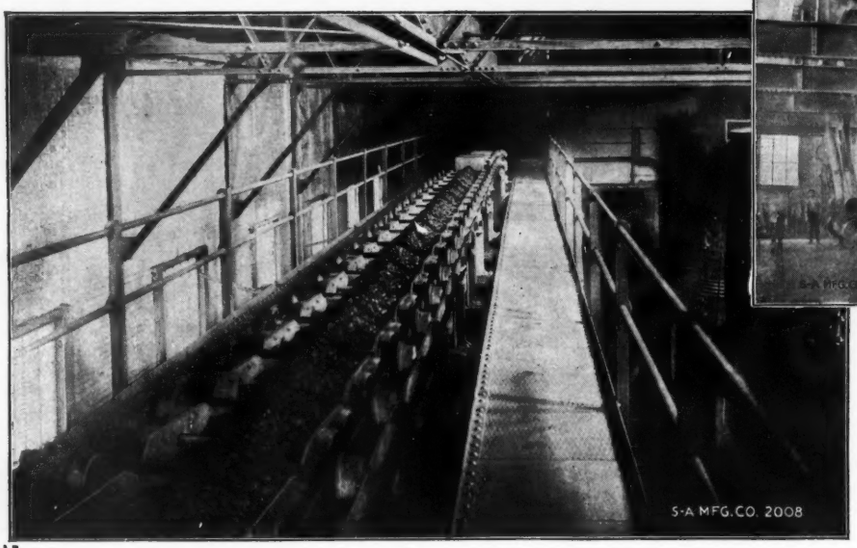

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OPENING UP A PROSPECT IN THE STATE OF PUEBLO, MEXICO

Examining and Developing the Mine Prospect

By HARRY T. CURRAN*

Often the failure of a mine prospect is due to incorrect or exaggerated reports regarding the property, and these result from the lack of sufficient development to thoroughly "prove" the prospect, or to an excess amount of exploitation in a vain effort to "make a strike" when returns are lacking. Such instances are detrimental to local development, injurious to the engineering profession, and shake the confidence of investors. In this article the author outlines in a general manner what should constitute sufficient information to justify the development of a prospect.

THE principles to be observed in the examination and development of the mine prospect form an interesting subject and one open to much argument and discussion. The loose application of the term "mine" is a matter which engineers would do well to consider, for their own protection, as well as for the protection of the public. Of many mining claims in a district, only a few customarily have mineral showings that would entitle them to even the name of mining prospect. Among the prospects only a few are sufficiently promising to be called mines in the making, or, one might say, proved prospects, and from these few only one will ever develop into a mine. Two varieties of reports regarding prospects are entirely too prevalent. The first usually condemns the property without proper study, simply because it is a prospect, and the other attempts to camouflage the property into presenting the appearance of a mine through the use of a lot of psuedo-geology. Prospects, especially proved prospects, are receiving more attention than formerly from companies which are looking for mining properties. When the chances are fully understood, the development of good properties is one of the most attractive of mining investments.

Too many engineers are so satisfied with their ability to make a successful diagnosis after the property has passed into a productive stage that they lose sight

*Mining and metallurgical engineer, Idaho Springs, Colorado.

of the fact that it is a greater accomplishment to be able to predict the future of a prospect through deductions reached by analytical observation and the application of correct theory of ore deposition. Of course, many a beautiful theory is "knocked into a cocked hat" by a little digging, and analogy is dangerous unless modified by a good deal of experience. However, an experienced engineer, fortified by a thorough knowledge of mining geology, should at least be able to predict what a certain amount of work, rightly placed, will do toward proving the property, and whether or not surface indications warrant the expenditure necessary for its accomplishment. If the engineer has stated conditions plainly, there can be no reflection on his judgment if the advised work proves the property to be worthless.

If mining geology is of any value it is certainly applicable to the higher geological horizons, even though it is not as easily proved as in the lower. Surface signs and indications exist, and conclusions can be drawn from them by sound reasoning. Beyond facts that can be demonstrated—such as ore blocked out and other established conditions—the conclusions drawn in a report form only an opinion, regardless of who writes them, and should be as freely given in one class of mining property as in another if the engineer is to cover his field completely. Many reports show not one iota of individuality, but simply follow an antiquated form, with a conclusion tacked on at the end that shows absolute lack of analytical observation.

Need of Determining Geological Conditions

Sizing up a prospect is a different problem from examining developed mines, in which the ore blocked out can be easily measured, the ore "in sight" determined within reasonable limits, and the probable and possible ore approximated. Examining and reporting on developed mines is to a much greater degree a matter of measurements and mathematics than with the prospect. Before attempting to express an opinion on the latter, an engineer should have had a varied experience in many different districts and a firm grasp on practical mining geology. He should be able to determine quickly whether the geological conditions of the district are favorable or not. What is needed is the ability to determine relative ages, to recognize the relation of ore to a certain rock, or rocks, in the district, and to follow that formation.

Determining Relative Age of Series

The relative age of a series may often be determined by following a few simple rules. By the rule of superposition, the younger of two strata is usually the upper one; if the folding has been so great that the beds have been overturned, some other method can often be found. The more metamorphosed of two rocks lying close together is probably the older, or often the one which shows the most evidence of disturbance, such as faulting and folding, is the older. Where a conglomerate is found, one may often trace the pebbles back to their origin. If it is possible to determine to which types—fundamental, intrusive, or extrusive—the rocks over a given area belong, the engineer has still another basis for correlation.

Physiography has a certain relation to mining, though probably to only a limited extent in many cases, but it should not be overlooked. The late Doctor Van Hise, speaking of the horizontal element, said:

> Commonly, ores deposited by ascending waters would be found below the valleys, or at least below the lower parts of the slopes; for these are the places where the waters are ascending in the trunk channels. Commonly, ores deposited by descending waters would be found below the crests or below the upper slopes of elevations; for these are the places where water would be descending. Probably the upper slopes would be more favorable places than the crests; for at an annular belt upon the upper slopes of an elevation the quantity of the descending waters would be greater than at the crests. Commonly, ores which receive a first concentration by ascending waters and a second concentration by descending waters would be on the slopes, in many instances nearer the valleys than the crests.

Study of the earth's surface imparts a general knowledge of the topography caused by faults and folds. When it becomes necessary to solve some function of a fault with no more than surface indications as a guide, a clear understanding of the causes which are accountable for the present topography is necessary. This is also true when applied to problems of secondary enrichment, which will be discussed later.

In general, areas of regional vulcanism are most favorable for ore deposition. Almost invariably, lode deposits of gold and silver are found in areal association with intrusive igneous rocks. The genetic connection that exists is often largely problematical, but that they are genetically related is well established from the fact that this intimate association has been noted in nearly every region where such deposits have been studied. Faults and fractures are developed and conditions necessary to ore deposition are present. As each district has its peculiar rock and metal association and surface characteristics, it also has its peculiar type of topography, governed by natural distribution, relative hardness, nature of faulting, folding, and other attributes. A much-faulted region is likely to be marked by step-like outlines. Low, rounding hills are often the results of complex faulting with at least two systems of intersecting faults.

The Relation of Surrounding Mines to a Prospect

The underground workings of a prospect are generally so meager that the engineer, before submitting a report or forming a conclusion, should visit as many mines and partly developed mines in the district as opportunity affords. Veins in a given area often follow definite systems, and a developed property in the district may throw considerable light on the region as a whole. There seem to be no general laws that can be safely applied to the influence of country rock on mineral veins. However, the vein structure and vein filling are both influenced by the inclosing rocks. The first is a physical effect; the second, mineralogical or chemical.

As chemical reactions in a laboratory are governed to an extent by the physical conditions, so will the vein filling be governed by the vein structure to greater or less degree. The engineer will be more interested in the physical effect, as it is more practically applicable and primarily governs the conditions under which the chemical reaction must take place. In other words, whether the channels are favorable or unfavorable receptacles for ore deposition depends to a great extent upon the physical conditions. The rocks, primary to

vein formation, must be either porous or fractured, to permit the circulation of enriching waters. It is evident that, over a given area, there is a probability that the rocks of the same type will not vary much in toughness, hardness, and porosity, and that the physical aspects of ore deposition will be governed by the nature of the rocks.

All forms of vein deposits are to some extent affected in size, shape, and richness by the character of the fissure, and by passing from one type of inclosing rock into another. The vein is likely to widen in an easily shattered material, pinch in a tough rock, and split into small stringers in brittle or soft rock, with the mineral so disseminated that the deposit becomes worthless; or the fissure may be replaced by a flexure and the deposit be entirely lost. Also, the type of deposit may be entirely altered, as, when a vein system passes from an area of granitic rocks, or rocks of similar physical characteristics, to an area of schists, it often changes from a system with few open fissures to one with many small, tight fractures. Though fissure filling would be the predominating process of ore deposition in the former, replacement would take place in the latter.

As one type of rock may present entirely different physical characteristics in different districts, no rules can be given for all localities, as each district may present certain peculiarities over a considerable area. Though no general laws have been formulated for rock and mineral association, a certain definite relation prevails in some districts, and often a developed mine will establish this relation for the district. However, each individual mine in a district, in fact different sections of the same mine, may present problems entirely separate and distinct from others in the same mine and locality. These peculiar characteristics may, nevertheless, be duplicated, and all distinctive conditions should be studied and applied along broad lines, such as can reasonably be expected to be fundamental to the ore deposition of the district.

Walter Harvey Weed draws the following conclusions from his observations:

> The structural character of vein fissures, such as course, width, etc., varies with the nature of the country rock. The mineral contents of veins formed wholly by the filling of open fissures are not affected by the nature of the vein walls. The mineral contents of ore deposits formed by metasomatic replacement vary with the nature of the inclosing rocks. As metasomatic processes vary in character with the nature of the solutions, no invariable general relation can be established between certain rock types and rich ore deposits.

A great majority of lode deposits are the result of a partial deposition in preëxisting fissures and are partly replacements of wall rocks through a process of metasomatic action. Open spaces probably can exist to great depth, but fissure veins formed only by the deposition in open spaces are rare. In refractory rocks, such deposits are undoubtedly found, especially where the trunk channels are simpler. However, metasomatic action is usually seen in the inclosing rocks of fissures. Edson Bastin,[1] speaking of the alteration of wall rock in the Central City Quadrangle, says:

> The association of minerals formed by replacement in the walls of filled fissures is in general different from that deposited in the fissure itself, in spite of the fact that both mineral associations were obviously formed almost contemporaneously and under the same general conditions of pressure and temperature. One of the most striking exemplifications of these contrasts is the scarcity or entire absence of galena and sphalerite in the walls of many fissure fillings in which these minerals are very abundant; in such walls pyrite is the dominating sulphide. Carbonates may be present in a filled fissure but absent from its walls. Conversely, sericite, the commonest alteration product in the walls, is never found in the fissure fillings.

The influence of wall rocks in many cases has a great bearing on vein fillings. Where the vein cuts different kinds of rock the replacement is usually selective. This may indicate a replacement of the rock as a mass, as in limestone; a replacement of fragments, as in a conglomerate; or replacement of certain constituent minerals, such as ferromagnesian minerals, in basic rocks. This mineralogical effect is not easily studied in a district without a developed mine, or, better, several developed mines. In a region where there is an impervious stratum, either horizontal or vertical, cutting a large area, this is the limit of circulation in that direction, and often a line by which the district is entirely divided in the character of its deposits, both physically and mineralogically. When in folds, any of the combinations of porous strata with impervious layers may form a trunk channel and a favorable lodgment for many important ore deposits.

Preliminary Mapping of Geological Conditions Is of Great Advantage

A rough survey of the property and of the immediate vicinity under consideration is in many cases indispensable to intelligent analysis. A pocket transit will often give sufficiently accurate results, and the ground may be quickly covered. With the property and vicinity mapped, the general geological relations and their bearing on the ore deposits can be more readily determined, and with greater accuracy. Both longitudinal and cross sections are valuable. In conjunction with surface maps they are often a great aid, and will enable one to trace the surface migration of vein outcrops under surface material, which is often necessary when tunnel or shaft work is to be done at such concealed places.

Cross-sections are, of course, an easier matter where sedimentary rocks are present, as they generally conform to one another, whereas, with igneous rocks, this is seldom the case, nor do their boundaries have so constant direction as with sedimentary rocks. To reason out accurately the outlines of an igneous body below the surface is a difficult undertaking, although by careful work it may be approximated and a basis can be established on which to determine the rock type.

Different outcrops of veins, deposits, or impregnations are generally found to have a distinct bearing on one another. The intersection of two water courses is undoubtedly the cause of a large proportion of oreshoots. This may be the intersection of any combination of channels that offer free circulation to mineralizing waters. As this is true, the study of the physical structure or texture of the rocks is of paramount importance in determining the opportunity they afford for ore deposition through the circulation of aqueous solutions. The richest portion of an oreshoot in strong veins is likely to be at the intersection of fractures or small veins, or where the fracture is complex, such as crushed zones, or zones of brecciation.

Underground circulations have often followed the larger openings, but the deposits are likely to be richer

[1]Professional Paper 94, U. S. Geological Survey.

where there is greater opportunity for reaction between solutions and the rocks, such as fissures composed of many small openings. However, in many instances small fissures will so scatter the mineralization that the deposit is worthless.

A small amount of work, rightly placed, will assist materially toward an understanding of these conditions, if the property is properly mapped and all details are tabulated and closely studied in the light of sound reasoning. Significant indications cannot always be found on the surface, but where they appear they may suggest concentration of large bodies at depth, or show a general impregnation of a large area, giving reason for the conclusion that the ore is scattered in small unworkable bodies.

It sometimes happens that a true difference in geological horizon can be found, due to erosion, and this may throw some light on the orebody with depth. A case of this kind was recently noticed on a property where the erosion was so rapid on one steep slope that permanent sulphides, such as could be expected to continue to a considerable depth, are found on the surface at a point more than 300 ft. deeper than the existing deepest workings. On the whole, erosion had just about kept pace with oxidation on this property.

Importance of Physiographical Features

Properties of merit generally exhibit surface indications that are noticeable with considerable distinctness even when in the prospect class. The type of deposit or vein can often be determined, and whether occurring under advantageous conditions or at auspicious contacts. Favorable decomposition of the rocks along the ore fissure, and oxidation that would suggest solfataric action conducive to ore deposition, are often to be observed, as are indications, in the outcrop, of thorough impregnation with ore, even though it be low grade, over a substantial width and length.

Primary ores are found on the surface when erosion has been so active that the top of the deposit is removed faster than oxidation proceeds. In this case a thorough impregnation of unworkable low-grade ores is of no value. In other words, there is no chance of secondary enrichment, and little chance of the ores increasing in value. Where the rate of erosion and oxidation is substantially uniform, the conditions are most favorable to enrichment.

A deposit that is porous or permeable and has impervious walls represents ideal conditions for enrichment. If the walls in general are shattered and porous, the enriching solutions may be dissipated and scattered. Climatic conditions and topography are factors directly responsible for or against enrichment. Here again the study of the physiographical features of the district is important, as the enriched zone generally conforms in a rough way to the topography that existed during the time of greatest enrichment. Later, the valleys or gulches have been cut faster than oxidation proceeded, and the only place to look for enriched ores is beneath the remnants of the old topography. Also, where enrichment has taken place under conditions formative of the present topography, the steep slopes are more unfavorable for the deposition of good ore than the gentle slopes. Though the topography to an extent governs the formation of secondary ores, it does not bear the same relation to primary ores. If an oxidized zone is too low grade to be of value, it, nevertheless, shows the presence of mineral, and often a close study of the rock alteration and of the oxidized ores that can be found leads to a clearer understanding of what may be expected with depth.

If a property has sufficient work accomplished to prove that a zone of secondary enrichment exists, the problem is greatly simplified. A thorough investigation of the ground should then be made, to determine, if possible, the extent of the zone and whether the primary ores that will be found at depth are workable. These questions are not always easily solved, but an approximate answer can often be given. A study of the topography, the probable ground-water level, and of climatic conditions will often make it possible to determine the probable depth of the secondary zone. The character of the primary ores can generally be determined by a study of the original sulphides that have been replaced. This often necessitates petrographical knowledge beyond the man in the field, but not beyond his reach.

Though favorable surface indications do not always guarantee valuable ore deposits, they are propitious guides to follow, and if entirely lacking the chances of finding ore are limited. Close observation and mapping are essential clearly to bring forth structural relationship that might otherwise be unnoticed. It is unusual to find more than one strong vein on a property, but seemingly unimportant stringers may often have a considerable influence on the vein.

It is true that "gold is where you find it," and, to a lesser extent, an analogous observation may be said to apply to many other mineral deposits. No inflexible rules can be formulated as to the examination of undeveloped mining properties, but there are usually many factors that point to favorable or unfavorable conditions, as the case may be. All indications of favorable conditions for ore deposition, as well as those which denote unfavorable conditions, should be seriously considered. The engineer should go into the field with an open mind, and not with the preconceived idea that a property is not worth thorough study, just because it is a prospect.

Developing the Prospect Into a Mine

The price paid for a developed mine usually represents the full value of the property, allowing for a reasonable margin of profit, plus the return of the capital invested. The intrinsic value is so readily determined from data available that there is no occasion for selling under this value. The great fortunes made in mining have been made by those who have developed the prospect into a mine. In development enterprises, one must, of course, keep in mind the element of chance. However, this can be reduced to a minimum by knowledge of precisely what the element of risk may be, by the provision of sufficient capital to develop a number of good prospects, and by engineering skill.

Developing prospects requires a combination of qualifications that it is not absolutely essential for a man who is in charge of a paying mine to have. In the latter case a good business man without special tech-

nical training is often entirely successful; the mine will stand the overhead expense of trained men for each department. With the company developing prospects, the condition is entirely different, and the average business man, or even the so-called practical man, without technical training, is often a failure. A man in charge of this class of work should have considerable technical ability, combined with business training and an aptitude for hard work. Overhead expenses are a vital consideration, and often the man in charge is called upon to be combined bookkeeper, assayer, surveyor, and mine manager. He should have had experience qualifying him to appraise the property with the smallest amount of work possible, know when to drop a property and when to carry the work still further, and where to place the work so that it will be effective. Most of the money lost by companies developing prospects is caused through the persons interested considering the property as a mine, and continuing work upon it as long as the money lasts, which, obviously, is the biggest kind of a gamble. If the following points were seriously considered there would be less money lost in prospecting:

Correct Understanding Necessary Between Stockholder and Company

The company should let every stockholder know that it is prospecting and developing, and not mining. Its officers and stockholders should know the chances they are taking and should have plenty of money to take up several good prospects if necessary. The physical conditions of a district should be thoroughly considered before development work is started. The questions of transportation, fuel and water supply, severe winters, and similar factors should be seriously weighed against indications of a good prospect in out-of-the way places. A property that promises to develop into a big-tonnage mine may warrant development work in an isolated district, with the expectation that it will be large enough to create future transportation facilities through its own merits. One must, in all cases, weigh the adverse physical conditions in a district against the promises of the property.

It should always be remembered during the development stage that the property is a prospect, and not a mine. To make a company see the advisability of giving up a prospect after a considerable amount of development work has been accomplished, and has proved it to be not what was first expected of it, is a difficult undertaking. Often the man who risks his money in this way has a confused idea of what makes a mining property valuable. Work rightly placed is of value, whether it proves the prospect to be or not to be a mine; but it can impart a value to the property only in the former case.

The Prospect Requires Practical Management

In prospecting, overhead expenses should be cut to a minimum. This is important, as they often amount to a greater sum than is put into actual development work. Far too many men are so impressed with their own importance, when given the place of manager, that they firmly believe a corps of assistants to be necessary, regardless of the number of miners employed. This, however, is much oftener the case with the man who knows nothing about mining than with engineers or practical men. The man in charge can also carry the reverse policy to excess and allow important matters to take care of themselves, while he is attending to small details that might better be left to subordinates.

The ore should be followed. Crosscut tunnels are not advisable in the early stages of development, except in unusual cases; either shafts, or adit tunnels where possible, offer the best means for exploration. A good cross-tunnel site is a temptation that often leads to the foolish expenditure of large sums of money. The amount thus spent is in many cases sufficient to indicate that several prospects are worthless, or to prove a good property to considerable depth. As a general rule, long crosscut tunnels should not be driven unless the ore is rather well proved to the depth that will be obtained by such work. Where the topography is favorable, adit tunnels are, of course, the cheapest method of development, and should be driven in at frequent intervals. However, the topography is often such that shafts must be put down, and they should follow the vein as long as the property is in the prospect class. Drifts, as with adit tunnels, should be driven at frequent intervals.

It is advisable to do the underground work in the cheapest and quickest way possible, in the early stages of development, even if some of the work will not be available for future use. If a mine is found, the property will stand the extra expense; if not, money is saved for the next property. Careless, slipshod methods are not to be sanctioned, but large, vertical shafts and features of construction that are warranted and necessary with a developed mine are foolish until the property is well proved.

Unnecessary Expenditures To Be Avoided

The installation of expensive equipment, for the sake of time saved or the saving of a few dollars per foot, is not advisable until the prospects of return warrant it. A mill is often installed after a few hundred tons of ore is developed. Nearly every mining camp is dotted with these monuments to over-optimism, and such premature expenditure needs no further comment. There are cases where conditions justify the erection of a small prospect mill after a few hundred tons of ore of suitable grade and character has been developed, and when the installation will materially help in a financial way. Each and every prospect presents its own peculiar problems, and these can be determined only by the man on the ground. What would be a foolish expenditure in one case might be a necessary one in another. However, one feature of mining which should not be overlooked in any case is the bodily comfort of the men. The labor expense is proportionately high in all mining operations, and it pays to keep the men satisfied.

One should not hesitate to throw up a property and look for another when a prospect is not making good. After a few hundred feet of development work has been accomplished on a property, it is often considered a mine, regardless of the amount of ore developed. This point of view is probably the greatest cause for losses in development enterprises. It is better to take a bond and lease on good prospects, even at a higher figure, than it is to buy them outright.

Because an old, abandoned mine has produced a large

tonnage of good ore in the past is no criterion that it will do so in the future. The investor is often attracted to old properties on account of their past record, but the great majority of such mines have degenerated into the prospect class and should be considered strictly on that basis. The geological conditions are more clearly proved, and often greater confidence can be placed in a campaign of development work than is possible with the surface prospect. Mexico is a field where the results obtained from old, abandoned mines have amply justified the confidence placed in them. However, the great majority of these mines had a large tonnage of low-grade ore on the dumps, as fillings in old stopes, and low-grade primary ores in place in the mine that were not amenable to the earlier crude metallurgy of the country.

Often a man in charge of development enterprises will have his attention called to a rich but small vein. Though such deposits are highly attractive to the individual, or lessee, they seldom would be remunerative enough for a company and should be approached with caution.

Thoroughgoing and conclusive assaying should be resorted to during development, and complete assay maps should be made. If a company should find it to advantage to place the property on the market at some future date, it will find such maps to be a valuable asset.

Development enterprises should be backed by an open-minded policy and good judgment, plus plenty of capital and frankness in all dealings, so that the backers may feel that they have invested in a business that has the average chance for success.

Mineral Exports of New Caledonia*

In the last three years recorded, New Caledonia exported the following quantities of ores and mattes:

EXPORTS OF ORES AND MATTES FROM NEW CALEDONIA

	1917	1916	1915
Ores and mattes of nickel, tons	32,017	35,614	54,105
Chrome ore, tons	41,892	74,115	57,474

Scarcity of tonnage resulted in a reduction of amounts exported. During 10 years previous to 1915 a decrease in the export of nickel ore was generally balanced by an increase in the export of chrome ore. Since that date nickel ore has been treated in New Caledonia, and mattes have been produced, and it is probable that ferronickel will ultimately be manufactured there, and, doubtless, ferrochrome also, thanks to electric furnaces and the abundant waterfalls in the region. Mr. Hugoniot, the engineer whose name is associated with the creation of the arsenal at Roanne, was sent on a mission some months ago to New Caledonia, to establish these industries, he having already had similar experience, before the war, at the Tao factory.

The following is a list of the exports of Caledonian ores for 1916, showing the countries of destination:

EXPORTS OF ORES AND MATTES FROM NEW CALEDONIA IN 1916
(In Kilograms)

To	Nickel Ore	Nickel Matte	Chrome Ore
France	7,807,000	783,000	9,300,561
England	20,129,045	800,000	31,308,377
Japan	2,743,100		15,728
United States	.....	3,352,067	33,490,876

*Translated from *Metaux Alliages et Machines.*

From this it will be seen that only an insignificant proportion goes to France, the greater part going to England, the United States, and, since 1917, to Japan. The sole exporters of nickel are La Société Nickel and La Société de Hauts Furnaces de Nouméa. The first sends its products principally to the factories of Havre and Glasgow; the second exports mattes chiefly to the U. S. Nickel Co., New Brunswick, N. J. The smeltery of the Société Nickel started work in 1912. It is situated near the sea, and is connected with the mines by eight miles of railway. Besides the two cupolas of 50 tons each by which 45% mattes are obtained, the company installed, in 1916, a bessemer converter for secondary fusion, by which the grade of the mattes can be raised to 76%. In 1916 the company bought out the Tao factory, which was in the market as a result of the liquidation of the Société Electro-Metallurgique de Tao. There are four electric furnaces, capable of treating five tons of ore per day, installed in this plant.

La Société de Hauts Furnaces de Nouméa, situated at the end of Donambo, at Nouméa, began operation in 1910. The ore was then treated by eight cupolas, each containing 12 to 14 tons. A 60-ton cupola was set up in 1915, and, in 1916, another of 50 tons. The company is now putting in a bessemer converter, by which the grade of the mattes can be raised to 75 per cent.

La Tiebaghi Co. and M. Rigaulib are the exporters of chrome ore. Le Chrome Co. stopped its works in order to use the waters of the lake plain, and to construct a powerful electrometallurgical plant at Yate, but Hugoniot's visit will probably cancel this plan, because it would result in the direct manufacture of ferrochrome and ferronickel.

New Caledonia taxes exports for the profit of the colony. The value of ores is fixed by the Official Commission of Averages. The value of nickel ore increased from 30 to 60 fr. a ton from 1914 to 1916, whereas that of nickel mattes increased from 600 to 900 fr. a ton.

The values of ores at the port of export were fixed as follows for the first three months of 1918:

Chrome ore containing 50% and below, 75 fr. per wet ton; plus 2 fr. (50c.) for each unit above 50 per cent.

Nickel ore containing 5.74% and below, 75 fr. per wet ton; 5.75 to 5.99%, 69 fr.; 6 to 6.24%, 75 fr.; 6.25 to 6.49%, 80 fr.; 8.50 to 8.74%, 86 francs.

Antimony ore containing 15 to 29%, 200 fr. per ton; 30 to 49%, 400 fr.; 50% and above, 700 francs.

Cobalt ore containing 4% and below, 40 fr. per wet ton; 4 to 5%, 50 fr.; 5 to 6%, 70 fr.; 6% and above, 90 francs.

Copper ore, 50 fr. per wet ton.

Phosphates, 60 fr. per ton.

Samples of all other products, 5 fr. per ton.

The "ad valorem" duty provided by the law of Sept. 3, 1913, is calculated at the rate of 50% of these amounts.

The Value of Quinine in the treatment of malaria has again been demonstrated. Dr. R. C. Derivaux, medical officer in charge of malarial investigation of the U. S. Public Health Service, has recently insured a reduction of 64.45% in the number of cases of the disease, as indicated by blood examination. The experiment was carried out at Lake Village, Arkansas.

Inclined-Shaft Timbering and a Method Of Alignment

By ARTHUR NEUSTAEDTER*

Advantages of sinking an inclined shaft, when conditions favor that type, are such that careful timbering, grading, and alignment will secure results equivalent to those obtainable in vertical shafts. Certain points must be given consideration in inclined-shaft timbering, and matters of suspension and support are paramount. An interesting and accurate method of inclined-shaft instrumental alignment is felicitously described.

IN THE Sept. 7, 1918, issue of the *Journal* appeared an article under the title "A New Timber Set for Inclined Shafts," by James E. Harding. An important point brought out was the necessity of allowing a rise above that of a right angle to the dip for the hanging-wall member of an inclined shaft set. This does not seem to be universally known or applied, and an extended article covering this point more fully, and dealing with the details of inclined-shaft timbering and the method of aligning and squaring, will doubtless be of value.

As pointed out in the article mentioned, both vertical and inclined shafts have their respective advantages, but ordinarily not as much care is taken in the alignment and proper timbering of an inclined shaft as is the case with vertical shafts. In consequence, troubles have arisen which have militated against the adoption of the inclined shaft where conditions were in its favor. In choosing between a vertical or an inclined shaft, there need be no hesitancy in deciding upon the latter if the conditions favor it. If timbered in an approved manner, properly aligned, and with sufficient attention paid to the uniformity of slope, the inclined shaft is as safe as a vertical shaft, can be equipped for the same hoisting capacity, and maintained as easily or more easily.

Conditions Governing the "Rise" in Inclined Shafts

The collapse of the four inclined shafts on the south end of the Comstock Lode, commented upon by Mr. Harding, was due, no doubt, to the hanging-wall members falling away after they became loosened in the process of moving below the position at right angles to the dip, although it would seem that something must have happened to the bearer timbers, as doubtless there were bearers in those shafts.

The amount of rise above the right angle allowed for in some of the inclined shafts on the Rand was, I believe, about ¼ in. to the foot; one shaft began with an allowance of about ½ in. to the foot, and this was thought to be too much. I have measured the downward movement of the hanging-wall members of a few inclined shafts in which the original sets were placed at right angles to the dip, and found a drop of from one to three inches below the right-angle position. The amount of rise necessary depends on the dip of the shaft, the nature of the ground, and whether the shaft is sunk with the vein or some distance back in the foot wall. I believe that the allowance for shafts dipping 75 to 50° should be from ¼ in. to ⅜ in. per foot above the right angle of dip and from ⅛ to ¼ in. per foot for those dipping 45 to 30°. The hanging members which have been given a rise may not lower to the right-angle position, but any settlement would at least tend to tighten the sets, and it would seem advisable to provide for this.

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Necessary Considerations for Inclined Shafts

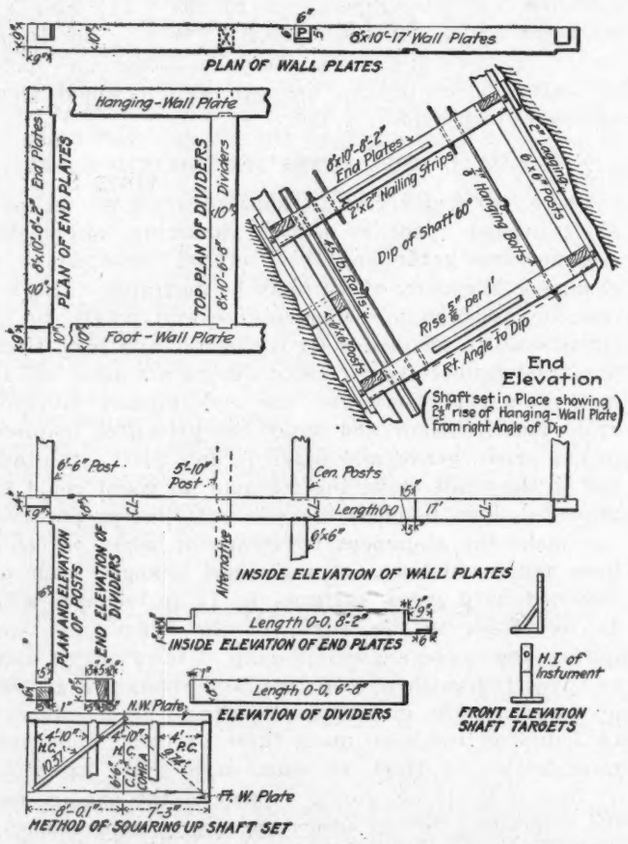
The speed and safety of hoisting from an inclined shaft depend upon the proper timbering, alignment, and uniform grade and true vertical curve where a change in direction of dip may be desirable. The accompanying drawings illustrate several points to be emphasized in inclined-shaft timbering, and from them any good timber framer could design a similar set to meet local conditions, and the underground surveyor could readily follow and apply the principles involved in alignment, grade, and squaring up. Should the task fall to the shaft crew, the foreman no doubt could be depended upon to place the sets with the proper rise and make the alignment by means of wires or chalk lines and plumb-bobs. A slope-level triangle, made of seasoned hard wood surfaced to 1½ in. square, with 18 to 24 in. as the length of the hypotenuse, and conforming to the angle of the dip of the shaft, if used in connection with a good level and straight-edge will give good results in placing the sets to grade. It will be found advisable to make three of these slope-level triangles at the start, all matched in every essential, so that if anything should happen to the one in use, the others may be depended upon to give a like slope.

The section of the shaft shown in the drawing is represented as being in ground that requires lagging on all sides. In shafts where the walls are good and that do not require timbers to support the hanging wall, sills, placed lengthwise across the foot wall and to grade, supported in hitches at the ends of the shaft and with supporting posts, are all that is required. If the distance between sets is greater than 6 ft., a false sill or tie between the regular sills is put in to support the tracks.

End Plates Support the Wall Plates

It will be noted that the hoisting compartments are each 4 ft. 10 in. by 6 ft. 6 in. in the clear, and this area will accommodate a skip running on a 36-in. gage track with ample clearance, and a special mule car which will permit a 900-lb. mule to stand on the level floor while being transported. The pump compartment, though only 4 ft. in the clear lengthwise of the shaft, has ample room for a ladderway in the center, an air line on one side and a water column on the other, and the width between wall plates permits of sufficient room

for any other necessary pipes or wires. This inclined-shaft set is framed substantially as a regulation vertical shaft set, with the exception that the end plates support the wall plates, so that the hanging bolts are naturally suspended from the end plates. There are no guides, and the vertical pressure is less, so that the posts may be of smaller cross-section and it is not necessary that they shoulder over on the full end cross-section of the plates, nor overlap the divider tennon, as in vertical-shaft timbering. However, if the ground be heavy enough to require larger posts, they may be placed in the same way. All posts are notched



DETAILS OF TIMBER SETS FOR THREE-COMPARTMENT INCLINED SHAFT

on one side, and so placed that, should one become loosened, it may be seen. The members of a set are squared, no allowance being made for the lack of squareness as affecting the hanging- and foot-wall position of the timbers, as otherwise there would be a tendency to defeat the object sought. Though the lower edge of the inside of the foot-wall plate projects slightly, and the posts do not butt up squarely, the deficiency is hardly noticeable, and is not of moment.

Templets Used in Framing of Timber

The framing of the members of a shaft set is done by means of templets which are carefully made from the specimen set and put away when not in use. It is advisable to keep the specimen set on top, so that it can be referred to by the framers until they can go ahead mechanically. Plate members having the same thickness, whether below or above the standard size sought, should be selected. The centers of all the compartments of the foot-wall plate, and the center of the hanging-wall plate of the middle compartment only, are marked by a saw cut to be used as a guide in aligning, squaring, and indicating centers of the tracks and ladderway.

After a section of the shaft has been trimmed and made ready to place the next set, or, better still, prepared so that three or four sets can be placed, the end plates are sent down and hung to the set above. Wall plates, posts, and dividers follow, with a supply of blocking and wedges, and after placing the timbers and moderately tightening up the set, the timbers are wedged lightly, lined and set to grade by eye. Assuming that more than one set is to be lined up, the procedure is to place the lowest set first with the transit, and then the others are brought to line and grade by the use of a chalk line and straight-edge.

Method of Instrument Alignment of Sets

In lining up the sets with a transit, the wooden base to which the instrument is secured in the transit case should have four holes bored through it, so that it may be screwed down centrally over the saw cut on the inside face of the middle compartment. Having secured the instrument base centrally to a set known to be exactly in line and to grade, the instrument is screwed to it with one set of leveling screws placed in the line of sight down the shaft and the cross axis leveled with the other set, as near as may be. One of the targets, as shown in the sketch, is provided with fine wire cross hairs fixed over a hole, the purpose of which is to permit the observer to see the cross hairs by reflected light against a background of tracing cloth. The cross hairs should coincide with the height of instrument above its position, as the target is held centrally over a checked set some distance down the shaft when the sights are taken. A similar target is held centrally on the set to be lined up and is then brought to the grade line, as projected from the instrument to the first target, by wedging. This brings the set to grade at the center of the middle compartment. Next, place the striding level on the cross axis of the transit and level up. Repeat the operation of sighting for alignment, but this time the set should be wedged in such a way as to bring the saw-cut centers of both foot- and hanging-wall plates in the line of collimation. To square up the set and prevent the tendency of the shaft to "corkscrew," place a measuring stick, which is provided with marks corresponding to the hypotenuse length of the squared set from the saw-cut of the hanging-wall plate to the inside corners of foot-wall plate (10.37 ft. and 9.74 ft. in the set illustrated), and wedge the set to coincide with the marks. The alignment and grade should be checked, and it is well to see, also, how the grade line in the other compartment checks with the sets above. By means of lights held near the track, any inequality of grade may be detected when the skip is hoisted.

The rise from a right-angle position is given a set at or near the collar of the shaft and again below every bearer set. A templet is made of 3 x 3-in. dressed lumber with 30- to 36-in. sides, and is used to set the rise. One side is held against a straight-edge placed against the inside slope of the foot-wall plates. The end plate is then elevated to conform with the other side. Both wall plates are leveled along their

length, and the other end plate is then checked up.

As the method of framing will make the distance from center to center of both hanging- and foot-wall plates of any adjoining sets the same, the rise will be maintained, though it is well enough to check up about every eighth or tenth set. The first set below any of the bearers will require that the posts from this set to the bearers be cut to measure, as they will vary in length; also, they will have to be spiked to the bearers, as it is inconvenient to tap them when in place. Bearers are placed every 80 or 100 ft., or near a station.

Credit must be given my son, Harold A. Neustaedter, mining engineer, for devising the instrumental method of inclined-shaft alignment.

Prevention of Illness Among Mine Employees*

By A. J. Lanza

The prevention of illness among the employees of mining companies is especially desirable, in view of the importance of the industry, the unsettled conditions of labor, and for humanitarian reasons. The burden of chronic illness is altogether unwarranted and unnecessary. If the industry is to maintain an efficient labor force, it is essential that it make every effort to keep employees in good physical condition.

The basic principles underlying health conservation are the same for any industry, but they are here applied especially to the mining industry, and more particularly, perhaps, to metal mining, as it is with this phase of the industry that I am most familiar. Moreover, metal mining presents more health hazards than coal mining.

The first step in the prevention of illness lies in securing employees who are in sound health and free from organic disease. I do not mean that all men who go underground should be physically perfect, but they should be free from organic defects of the heart, lungs, and other organs, or from anatomical defects that would markedly increase their liability to accident. The number of men working underground in mines in this country whose physical condition totally unfits them for such work presents a situation that should not be allowed to continue, and which I believe is not equalled in any other industry in the country. There is only one way to secure men who come up to the required standard, and that is by a thorough physical examination before employment. I am fully aware of the objections felt toward such a procedure by many employers and employees. There is much to be said on both sides, but to any one who is at all familiar with the mining industry as it is today in this country, and who approaches the matter with an unbiased mind, there can be no doubt as to the necessity for physical examination. As a purely logical proposition this is self-evident; but there remains the further necessity of placing physical examinations on such a basis that they can be carried out in a just and equitable manner and free from the abuses and suspicions to which they have been subject.

The best way of conducting physical examinations is by properly constituted authorities of the various states. That is, if John Jones wished to work as a miner, when he appeared at the employment office of the Smith Mining Co. he would have in his possession a certificate from the state authorities declaring him to be free from organic or other defects that should, in the natural order of events, bar him from underground work. Such a system would presuppose reciprocity among the mining states and a basic standard of physical fitness. It would be well within the province of the Federal Government to establish such a standard for adoption by the various states. This arrangement may seem idealistic and impracticable, and it is offered here largely for the purpose of causing reflection and argument; but at the same time, unless the mining industry can put into effect a system that will be fair both to employer and employees, and that will prevent obviously unfit men from working underground, it will be almost useless to make any other effort toward prevention of illness among employees. I believe that the time has come for the American Institute of Mining Engineers to consider seriously the necessity for and the means of carrying out physical examinations, and to take a definite stand.

The second requisite for the prevention of illness among employees is the maintenance of working conditions underground on a high plane of sanitation and efficiency, so that illness arising from unsanitary conditions may be reduced to a minimum. The greatest need in the improvement of underground conditions is the elimination of dry drilling. The relationship between hard-rock dust and miners' phthisis has been so clearly demonstrated that it is not subject to argument. Suffice it to say that the efforts made in England and in British colonial possessions to deal with this evil have shown the possibilities of abating it, though in this country little has been attempted. So long as dry drilling is permitted in hard-rock mines, just so long will we have an inordinate amount of pulmonary disease among the miners. That this has worked an economic hardship on the industry, aside from its humanitarian features, and that it has been one of the causes of the better grades of mine labor leaving the industry, is apparent to any one familiar with the conditions; and it is hard to understand why the subject of dry drilling has received so little attention in this country. Dry-drilling apparatus may be as deadly as a machine gun, if somewhat slower, and its continued use is a matter of reproach. Though it may be true that the water varieties of machine drills are not so satisfactory as they might be, at least the question of their improvement should receive serious attention. It is incredible that American ingenuity, which has produced the telephone, the telegraph, and the flying machine, should be unable to cope with the production of a water drill that would make miners' phthisis largely impossible.

Proper toilet facilities underground are important as a health measure, but vary so much according to the size and locality of the mine that they need not be gone into in detail here; besides, their principles are well understood. Adequate provision for medical and surgical service is also necessary, so that minor illness and injuries may be promptly treated and not become of major importance. The "safety-first" movement has become highly specialized and efficient. Health service, if I may use this term, has not been developed in the

*Abstract from a paper to be presented at the New York meeting of the A. I. M. E., February, 1919.

same proportion. Although many of the larger mining companies maintain first-class hospitals, the prevention of sickness among miners has not kept pace with the prevention of injury. It is just as feasible to distribute posters and other educational matter dealing with the proper care of common colds, constipation, and other minor troubles, which are forerunners of serious ailments, as it is to impress on the miners the necessity of having the smallest injury promptly attended to by the company doctor. There is a need for a closer coöperation between the doctors and the miners in handling the minor ailments when they first appear. In former days, the miner was an English-speaking person, with all the advantages of a knowledge of the country and its institutions. At present, underground workers are largely foreigners, and the employer must provide for their health during working hours, and often in their homes, if he desires to keep them on the job.

It is probable that the mining industry will always be hazardous to health and life as compared with other industries, but at present it is needlessly so, because the wastage of human material can be prevented by securing physically fit labor, and by keeping its health unimpaired.

Average Prices of Principal Metals For 24 Years

The table herewith presented records in convenient form the average prices of the principal metals from 1895 to 1918, inclusive, in New York, and in the cases of some metals the average yearly price at London and St. Louis. Quotations for copper, lead, tin, spelter, antimony, and aluminum, in New York or St. Louis, are in cents per pound. Quicksilver prices are per flask of 75 lb. Silver and platinum are quoted in dollars per ounce. All London quotations are given in pounds sterling per long ton.

AVERAGE PRICES OF PRINCIPAL METALS 1895–1918

	Copper		Lead		Tin		Spelter			Anti-mony,	Quick-silver,	Alum-inum,	Silver,	Plat-inum,
	Electrolytic													
Year	New York	Lon-don	New York	Lon-don	New York	(a) Lon-don	New York	St. Louis	Lon-don	New York	New York	New York	New York	New York
1895	10.76 (b)	.....	3.23	.....	14.05	63.333	3.63	.....	.....	7.560	39.58	58.66	65.250	.....
1896	10.88 (b)	.....	2.98	.....	13.29	59.496	3.94	.....	.....	6.650	37.00	50.75	67.060	.....
1897	11.29 (b)	.....	3.58	12.367	13.67	61.400	4.12	.....	.....	6.750	38.50	39.00	59.790	.....
1898	12.03 (b)	.....	3.78	12.983	15.70	71.204	4.57	.....	.....	8.690	40.70	30.58	58.260	.....
1899	16.67	.....	4.47	14.933	25.12	122.429	5.75	.....	.....	9.430	43.63	32.72	59.580	15.22
1900	16.19	.....	4.37	16.987	29.90	133.575	4.39	.....	.....	9.500	51.00	32.72	61.330	18.09
1901	16.11	.....	4.33	12.521	26.74	118.633	4.07	.....	.....	8.250	47.00	33.00	58.950	20.00
1902	11.626	52.460	4.069	11.262	26.79	120.720	4.84	.....	.....	6.120	48.03	33.00	52.160	19.00
1903	13.235	57.970	4.237	11.579	28.09	127.320	5.40	5.191	.....	6.000	41.32	33.00	53.570	18.91
1904	12.823	58.884	4.309	11.983	27.99	126.733	5.100	4.931	.....	6.371	41.00	35.00	57.221	19.50
1905	15.590	69.465	4.707	13.719	31.358	143.083	5.882	5.730	25.433	10.250	38.50	35.00	60.352	20.34
1906	19.278	87.282	5.657	17.370	39.819	180.646	6.198	6.048	27.020	21.730	40.90	35.75	66.791	28.04
1907	20.004	87.007	5.325	19.034	38.166	172.638	5.962	5.812	23.771	14.840	41.50	45.00	65.327	30.98
1908	13.208	59.902	4.200	13.439	29.465	133.124	4.726	4.578	20.163	8.004	44.84	28.70	52.864	16.32
1909	12.982	58.732	4.273	13.042	29.725	134.774	5.503	5.352	22.185	7.466	46.30	22.00	51.502	24.87
1910	12.738	57.054	4.446	12.920	34.123	155.308	5.520	5.370	23.050	7.386	47.06	22.25	53.486	32.70
1911	12.376	55.973	4.420	13.970	42.281	192.353	5.758	5.608	25.281	7.540	46.54	20.07	53.304	43.12
1912	16.341	72.942	4.471	17.929	46.096	209.420	6.943	6.799	26.421	7.760	42.46	22.01	60.835	45.55
1913	15.269	68.335	4.370	18.743	44.252	201.679	5.648	5.504	22.746	7.520	39.54	23.64	59.791	44.88
1914	13.602	61.524(c)	3.862	19.076(c)	34.301	156.564(c)	5.213	5.061	22.544(c)	8.763	48.31	18.63	54.811	45.14
1915	17.275	72.532	4.673	22.917	38.590	163.960	13.230	13.054	67.553	30.280	87.01	33.98	49.684	47.13
1916	27.202	116.059	6.858	31.359	43.480	182.096	12.804	12.634	72.071	25.370	125.49	60.71	65.661	83.40
1917	27.180	124.892	8.787	30.500	61.802	237.563	8.901	8.730	52.413	20.690	106.30	51.59	81.417	102.82
1918	24.628(d)	115.530	7.413	30.100	(e)	330.138	8.159	7.890	54.180	12.581	123.47	33.53	96.772	105.95

(a) Prices of tin, London, from 1895 to 1914 from statistical report of Metallgesellschaft, Frankfurt-am-Main. (b) Prices 1895 to 1898 are for Lake copper. (c) Averages of nine months, no quotations being made during August, September, and October. (d) Average of 11 months, no quotations being made in December. (e) No average computed.

The quotations for copper are for electrolytic copper beginning with 1899, but for Lake copper in the preceding years; London copper quotations are for spot standard copper. The lead prices are for common lead; spelter for ordinary brands or prime western; tin prices at New York are for spot Straits tin and the London quotations for spot standard tin; antimony quotations are for spot, ordinary brands; aluminum prices are for No. 1 ingot, but represent the uncontracted market, which is in the main metal offered for resale, the bulk of the aluminum production entering consumption on long-time contracts. Silver quotations at New York are for bar silver, 999 fine.

Cape Copper Co., Ltd.

The accounts for the Cape Copper Co., Ltd., a corporation owning mines in Namaqualand, Cape Colony South Africa; in the Raqua Hills, in India, and in Newfoundland, show that there is a deficit of £64,146 for the year ended Apr. 30, 1918. Conditions brought about by the war seriously affected the company's operations during the year. In Africa it was found impossible to work the smeltery for more than 170 days, on account of lack of coke. Copper production was therefore reduced to less than half of the previous year's output. Cost of production has increased in inverse proportion.

In India, the blast furnace could be worked for only about two months, for the same reasons that restricted the African production. Operations during this trial run were, however, satisfactory. Materials for the erection of a refinery were delivered; and a Minerals Separation flotation unit has been added to the concentrating mill. A portion of the converter plant was erected during the year, and small-scale tests resulted in the production of blister copper assaying 98.8 per cent.

The company, which has paid dividends amounting to £3,108,750 on the ordinary, and £403,425 on the preference shares, since its inception in 1899, anticipates a return to normal prosperity when the war restrictions on commerce have been removed and more stable and normal operations become possible.

Southport Miners Ask Increase

The Southport Miners' Federation, says a London dispatch, which demanded on Jan. 15 that the government demobilize all miners in the army, also decided by a majority of more than two to one to demand an advance of 30% over the present wages other than those classified as war wages.

Magmatic Iron Ore in Arizona

BY SYDNEY H. BALL* AND T. M. BRODERICK†

INTERESTING genetic relations warrant the description of a group of iron orebodies in Arizona, which from their titanium content, small size, and relative inaccessibility may never be important enough to be mined. These iron orebodies are differentiates of a gabbro, the gradation from gabbro to iron ore being particularly clear. At one locality the gabbro is massive, and here the iron ore occurs as irregular bunches in the rock; at another the gabbro is gneissic and the iron ore occurs in dike-like masses. Compared to other geological occurrences, the iron orebodies resemble some of those in the Adirondacks, New York,[1] described by Kemp. The senior author of this paper is responsible for the cursory field examination and the junior for the petrographic and chemical work.

The Eureka mining district is situated in western Yavapai County, Ariz., about 40 miles west of Prescott. The rock foundation of the region consists of contorted mica schists and basic igneous schists, which are intruded by gabbro and granite. This part of the rock series is probably of pre-Cambrian age. It is intruded by a monzonite boss of presumably late Cretaceous or early Tertiary age. After the period of intrusions the country was deeply and ruggedly carved by erosion, the irregularities being later leveled by the deposition of a conglomerate which resembles the Gila conglomerate at Globe and is approximately of the same age (Quaternary). Basaltic flows and intrusive sheets followed. The present topography is that of a slightly uneven upland, deeply dissected by steep valleys.

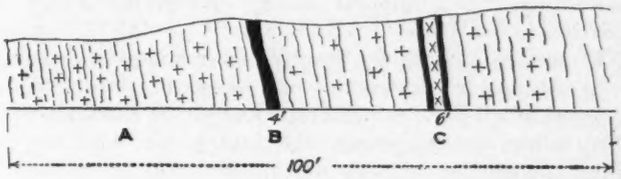
MINERALOGICAL OCCURRENCES IN THE EUREKA DISTRICT SHOW REPLACEMENT

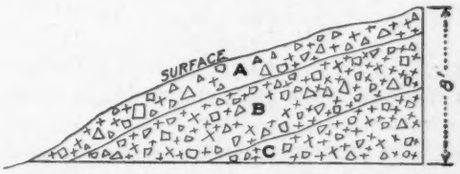
In addition to the iron-ore deposits, the district includes the property of the Bagdad Copper Co., a typical "porphyry copper," the country rock being the monzonite; the Copper King, a series of lenses of zinc blende replacing schists along a fracture zone; and the Hillside mine, a vertical vein cutting nearly horizontal mica schist and carrying gold and silver.

The iron-ore deposits occur along the medial line of a gabbro band, three-fourths of a mile to one mile wide and extending northeasterly and southwesterly. Cattlemen state that this band and its sporadic iron-ore deposits can be followed for 15 or 20 miles. The gabbro is intrusive in ancient schists and is cut by granite and aplite dikes.

The most northeasterly point examined by us is on the south side of Boulder Creek just below the mouth of Copper Creek. At this point the gabbro is a coarse-grained massive rock, the constituent feldspar and either hornblende or pyroxene grains being ¼ in. in diameter. Locally, through shearing, the dark minerals pass into a chlorite belt. Epidote is also locally developed. Some parts are practically without magnetite; elsewhere magnetite is an important constituent. Such rock grades rather suddenly into irregular masses, which are composed almost entirely of titaniferous magnetite. In one case a stream-polished exposure shows the gradation within 15 ft. from gabbro, in which magnetite is but an accessory mineral, to magnetite ore. In other examples, magnetite and gabbro are in fault-contact with one another.

A few tunnels and pits corroborate the surface evidence that the orebodies are small, although numerous. A typical occurrence as exposed on the side of an open cut is shown in Fig. 1. The iron ore varies from a compact fine-grained to a distinctly granular ore, the





STRUCTURAL SECTIONS, MAGMATIC IRON ORE

Fig. 1 (upper). Side of Open Cut Near Boulder Creek, Showing (A) Fine-Grained Iron Ore With a Few Feldspar Grains Grading Downward Into (B) Magnetite-Rich Gabbro Grading Downward Into (C) Normal Gabbro Containing Bunches of Magnetite-Rich Gabbro.

Fig. 2 (lower). Exposure Along Milholland Creek, Showing Dike-Like Occurrence of Iron Ore in Gneissic Gabbro. (A) Gneissic Gabbro Grading Sharply Into (B) Magnetite, Which Is Cut by (C) Gneissic Granite Pegmatite.

individual grains being ¼ in. in diameter. A little pyrite is visible.

As seen under the microscope, the Boulder Creek gabbro is relatively fresh. The pyroxene is only partially replaced by hornblende, and the feldspar (labradorite) is fresh and unaltered. The alteration of pyroxene to hornblende has taken place chiefly around the outside of the grains, leaving in most cases a core of the original pyroxene. Magnetite, ilmenite, pyrite, and apatite are accessory minerals. Secondary minerals, in addition to uralitic hornblende, are zoisite, leucoxene, epidote, and chlorite. There has been some strain upon the rock mass since it solidified, as is evidenced by the bending and wedging out of the albite twinning of the plagioclase. The ore is a magnetite-rich phase of the gabbro. Besides magnetite and ilmenite, a little original plagioclase and apatite and secondary uralite are present. Two samples gave the following analyses:

	Per Cent	Per Cent
Fe	60.09	62.02
Ti	9.80	8.20
Mn	Trace	Trace

Tests for vanadium, chromium, and nickel gave negative results.

A second exposure of the iron ore, on Milholland Creek, about 1¼ miles southwest of the locality just described, was also examined. Here the gabbro is

*Of Rogers, Mayer & Ball, 42 Broadway, New York.

†Dept. of Geology and Mineralogy, U. of Minn., Minneapolis, Minnesota.

[1] J. F. Kemp, 19th An. Rep., U. S. Geological Survey, Part 3, 1899, p. 377-422.

distinctly gneissic, and the iron ore occurs in discontinuous dike-like forms, which, however, grade into the normal gabbro. Several dikes are parallel to one another, all having a common extension parallel to that of the gabbro belt. The magnetite dike-like bodies, which are from 3 to 8 ft. wide, weather strongly in relief above the gabbro. The ore is slightly gneissic, and this is emphasized by narrow, parallel, lit-par-lit intrusions of gneissic pegmatite. The relations are shown in Fig. 2.

Under the microscope, the rock associated with the magnetite in this locality is seen to be a hydrothermally altered gabbro. The feldspar and the pyroxene have almost entirely disappeared, the former being replaced by a fine-grained mosaic consisting chiefly of epidote grains, and the latter by hornblende, chiefly of the fibrous variety, uralite. Magnetite, ilmenite, and pyrite are accessory constituents. In addition, there are a few small grains of a mineral having the properties of enstatite.

The ore is a massive titaniferous magnetite, with dark red bands consisting of secondary hematite. Scattered small patches of fibrous amphibole show that, before alteration, pyroxene was intergrown with the oxides. A partial analysis of the ore is given in the following table:

	Per Cent
Fe	60.35
Ti	8.40
Mn	Trace

Tests were made for vanadium, chromium, and nickel, with negative results.

Similar dike-like bodies of titaniferous magnetite which extend parallel to the banding of the surrounding gabbro, and grade into it, occur in other places. The origin of the primary gneissic, or fluxion structure of igneous rocks, in conjunction with the occurrence of bands of differing composition (such as the dike-like bodies of magnetite) parallel to the fluxion structure, has recently been studied by Grout.[2] As a result of his study, he suggests that the fluxion and banded structures may have developed during the crystallization of the magma as a result of processes of differentiation aided by convection currents. It is, however, possible that while this part of the partially differentiated gabbro mass cooled it was rendered gneissic by stresses from northwest to southeast, or vice versa.

[2]Grout, Frank F., "Internal Structures of Igneous Rocks: Their Significance and Origin, With Special Reference to the Duluth Gabbro," *Journal of Geology*, Vol. 26, p. 439-458, 1918.

Notes on Colloidal Metals*

By Jerome Alexander

It is an outstanding fact that many of the properties of substances are dependent, not on their chemical composition, but on the kind and degree of aggregation of their constituent particles. Thus, carbon, in one crystalline state of aggregation (diamond), is the hardest known substance; whereas in another crystalline state (graphite), it is so soft that it is used as a lubricant. Laying too much stress on the mere chemical analysis of substances is likely to obscure the fact that the nature of the aggregation of their particles is always a factor of importance, and sometimes the most important factor.

Colloid chemistry deals with matter in a fine state of subdivision. Its sphere begins with particles just a little smaller than a wave length of light and extends down until they blend into molecular dimensions. With particles of this size, such phenomena as surface tension and adsorption, which depend on the development of free surface, become enormously magnified. Thus a cube of 1 cm. edge has a surface of only 6 sq.cm.; but if it is reduced to colloidal dimensions by being cut up into cubes each having an edge of 0.01 u (0.00001 mm.), it will yield one million, million, million (1,000,000,000,000,000,000) such cubes, having a combined area of 600 sq.m., or 21,274 sq.ft. The tiny force with which a drop of rain clings to the window pane becomes a factor to be reckoned with, if the surface involved is increased millions of times.

From the colloid-chemical point of view, metals and alloys may be regarded as jellies or sponge-like structures, the viscosity or stiffness of which at ordinary temperatures is exceedingly great; and, like all jellies, their properties are dependent on the composition and degree of dispersion of their constituent phases. These, in turn, depend on chemical composition, mutual solubility, speed of chilling, subsequent mechanical and heat treatment, and other considerations. In fact, in preparing metals and alloys for practical use, it is usual to remove undesirable constituents (as in the conversion of pig iron into steel), add desirable constituents (as in case-hardening or making alloy steel), or to control the composition of particle size of the phases by chilling, rolling, or tempering.

It is a matter of importance which is the dispersed phase and which is the dispersing phase. For example, cream is an emulsion or dispersion of fat in water and wets paper, whereas butter is a dispersion of water in fat and greases paper. Though I have not yet examined the experimental facts in the case of metals, it seems probable that the relative surface tensions of the phases toward each other are important factors in determining the constitution of the matrix or dispersion medium, and in determining which substances shall constitute the dispersed phases. Substances that lower surface tension tend to collect at the interfaces and thus produce in the matrix, as well as in the dispersed phases, a fine degree of subdivision. Thus, according to Putz, the predominant effect of vanadium in steel is to decrease the size of the ferrite grains and make the material harder; it renders the ordinary structure due to pearlite fine-grained and homogeneous.

I believe that the application of the ultramicroscope to the study of the minute structure of metals will reveal much that is of interest. The great difficulty is in preparing sections of sufficient tenuity for examination. One means of preparing such thin metallic films was devised by Faraday, who floated gold leaf upon dilute cyanide solutions; and an intimation of what results may be obtained was given by Sir George Beilby in his Hurter Memorial lecture entitled, "The Surface Structure of Solids."[1]

Colloids exert a powerful influence on crystallization. Thus, plaster of paris crystallized from pure water

*Abstract from a paper to be presented at the New York meeting of the A. I. M. E., February, 1919.

[1]*Journ.* Soc. Chem. Ind., Vol. 22, p. 1166.

shows characteristic long interlacing crystals. The addition to the water of even 0.01% of gelatine delays the set and practically inhibits the crystalliation, there being formed, instead, spherocrystals. With the addition of 0.5% of gelatine, the time of set was increased from 40 min. to 960 min. Most metals have a powerful tendency to crystallize, which in many cases is strongly inhibited by various substances present; and because even small quantities may produce the result, it is obvious that they are in a finely dispersed state, and, in many cases, probably colloidal.

The change in dispersion of a substance with varying chemical composition of the dispersion medium may be illustrated by an experiment with ordinary soap, which dissolves in alcohol into a clear crystalloidally dispersed solution; even in the ultramicroscope no particles are visible. In water, however, soap forms a cloudy colloidal solution; and, if sufficient water is added to the alcoholic solution, a turbidity at once becomes manifest. If water is added to the slide under the ultramicroscope, the alcoholic solution literally explodes into millions of actively moving ultramicrons of colloidal dimensions. Another strong analogy to metals is exhibited by transparent soap. When quickly chilled, it shows very small ultramicrons, whereas when slowly cooled the ultramicrons are much larger and may make the soap cloudy. Still another analogy is found in gold ruby glass. When quickly cooled, this is colorless and shows no ultramicrons; but when reheated, the invisible nuclei of metallic gold grow into visibility in the ultramicroscope, and the glass develops a color. If the colorless glass has been formed under conditions insuring the formation of a large number of nuclei, the glass when reheated develops a large number of small ultramicrons, and the color is rich ruby red. If the initial chilling has been too slow, the nuclei are too few and too large, and when reheated there are formed a relatively small number of large masses of metallic gold, which give the glass a violet or dirty blue color. In such spoiled ruby glass, the aggregations of gold may be visible to the eye.

From what has just been said one can easily understand that when metals are heated so as to reduce their viscosity sufficiently their particles move to establish the tendencies toward aggregation that were arrested by the high viscosity consequent upon solidification. This accounts for most of the phenomena consequent upon tempering or annealing. Even at ordinary temperatures gold and lead diffuse into each other, but the motion of their particles is so slow that it is entirely invisible in the microscope and can be determined only after a long lapse of time. In fact, a cork, if given sufficient time, will gradually float to the top of a barrel of tar or asphalt.

Finally, I might mention the diffusion of gases into and through metals. The adsorption of gas is primarily a surface phenomenon. Particles within the mass of a phase are on all sides surrounded by particles of the same kind. Particles at the surface, however, have one side in contact with a different phase. The free surface or interface thus becomes the seat of a residual attraction or surface affinity. This is exhibited by freshly cleaved sheets of mica, which adhere if promptly put together, but in a few moments this property is lost, owing to the adsorption of atmospheric gases.

In the case of finely dispersed metallic systems, with enormous free interfaces, the adsorption of gas may weaken the attraction between the particles and render the metal brittle. In the case of gases with actively moving particles, the metal may be actually penetrated by the gas, as those who have to handle hydrogen know to their sorrow.

In conclusion, I would emphasize the fact that in nature all transitions are gradual. Ordinary coarse suspensions pass imperceptibly into and through the colloidal zone into actual crystalloidal subdivision, or so-called "true solution." Solutions pass so gradually into gelatines that we cannot determine the exact point where one ends and the other begins, and there is no sharp line of demarcation between physics and chemistry, which are connected by a twilight zone of colloidal phenomena partaking of the nature of both.

University of Illinois Research Work

To assist in the conduct of engineering research and to extend and strengthen the field of its graduate work in engineering, the University of Illinois maintains fourteen research graduate assistantships in the engineering experiment station. The assistantships, for each of which there is an annual stipend of $500 and freedom from all fees except the matriculation and diploma fees, are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics, or applied chemistry.

An appointment to the position of research graduate assistant is made and must be accepted for two consecutive collegiate years, at the expiration of which period, if all requirements have been met, the degree of master of science will be conferred. Not more than half of the time of a research graduate assistant is required in connection with the work of the department to which he is assigned.

Nominations to these positions, accompanied by assignments to special departments of the engineering experiment station, are made from applications received by the director of the station each year not later than the first day of March. The nominations are made by the executive staff of the station, subject to the approval of the president of the university. Nominations are based upon the character, scholastic attainments, and promise of success in the principal line of study or research to which the candidate purposes to devote himself. Preference is given those applicants who have had some practical engineering experience following the completion of their undergraduate work. Appointments are made in the spring, and become effective the first day of the following September.

The engineering experiment station, an organization within the College of Engineering, was established in 1903 for the purpose of conducting investigations in the various branches of engineering, and for the study of problems of importance to engineers and to the manufacturing and industrial interests of the State of Illinois.

Additional information may be obtained by addressing: The Director, Engineering Experiment Station, University of Illinois, Urbana, Illinois.

Zinc Smelting in India

AT THE annual general meeting of the Burma Corporation, Ltd., held recently, the chairman, Sir T. R. Wynne, made the following report:

The Indian market offers an excellent field for the disposal of lead. During the war the company's lead has obtained a very firm footing in India, which has relied on our product to supply its entire wants, and at the present time our lead is also in great demand for China and Japan. Lead, moreover, is a marketable product at all times, and I feel fairly confident in thinking that with our cheap labor, high-grade ores and other advantages, it will always be possible for us to produce this commodity at less cost than our competitors. With regard to our zinc concentrates, there are two courses open. The first is to sell our concentrates, and the second is to smelt them ourselves and sell the products. Dealing with the first course, in my opinion, this corporation might reasonably claim from the government the same treatment which has been given to Australia, namely, the purchase by it of our zinc concentrates output for a period of years. I take it that for the period of the arrangement with Australia the British government will control the sale of zinc concentrates produced in the empire, and dispose of them in such a manner that enemy interests may be prevented from securing any control over such important raw materials. Again, the industry of zinc smelting in England is developing, and will no doubt create a market for such zinc concentrates as we shall have for disposal after meeting our own requirements. With mutual good will, I see no reason why, when we have concentrates for sale, we should not be able to arrange for their purchase, on terms acceptable to both parties, by some of the new smelting works now being erected in England. I say "after meeting our own requirements," because it is extremely probable that it will be more profitable to smelt the major part of our zinc concentrates in India in works constructed and owned by the Burma Mines.

Possibilities of Zinc Smelting in India

In 1916 I suggested to the board that the government of India would, I thought, be ready to assist in the establishment of zinc-smelting works in India, and it was decided to approach it with a proposal. There were two reasons why such a proposition was attractive: (1) Because, owing to the great strides made in the development of Indian industries during the last few years, and especially during the war, India, with its freedom from labor troubles, cheap coal, and its proximity to the mines, offered an attractive opportunity for the establishment of zinc-smelting works; (2) because the Tata Iron and Steel Co. was anxious to secure a steady supply of zinc and sulphuric acid for its own purposes and for subsidiary companies, and was prepared to enter into a long-term contract with the zinc works for spelter and acid, and give every assistance in their construction and operation. The negotiations with the Indian government extended over a considerable period of time.

The terms offered provide for: (1) The grant of a new mining lease for 30 years; (2) the fixing of the royalty on the basis of 2½% of 30% of gross metal value of the ore at pit's mouth; (3) a loan not exceeding £200,000 up to half the cost of the new zinc-smelting works; (4) concessions as regards railway freight. In addition to the grant of a new mining lease for 30 years, the present lease having only 18 more years to run, we have received another letter from the government of India stating it would be prepared to recommend to the Secretary of State that the area of the lease should be increased to the full area allowed by the mining rules, namely, 10 square miles. The area of the present lease is only 3.8 square miles. The addition of this area is a valuable concession.

Under the terms of the existing lease, the royalty payable is 2½% on the salable value of the ore at the pit's mouth. The reduction to 2½% on 30% of the metallic value of the ore is also a considerable concession. On this basis, taking the average grade of the ore reserves at the end of 1917, namely, 25 oz. silver, 27% lead and 19% zinc, and the average price of metals for the 10 years before the war, namely, silver 28d., lead £15, and zinc £23 16s., the royalty comes to 1s. 8d. per ton of ore. If we assume as likely prices for the next 10 years as 30d. for silver, £15 for lead, and £25 for zinc, the royalty comes to 1s. 10d. per ton.

It might be urged that, in respect to the loan, the government of India might have taken a share in the provision of capital to build the zinc works, instead of offering a loan. The government of India, however, has, in offering us a loan, gone a great deal beyond its usual practice, and such action indicates an unprecedented concession for the government to make. It means a great deal more than a mere loan, as it indicates that the proposition is one that the government of India approves of, and I feel sure we can count on every assistance it can give us to insure the successful working of the enterprise. The board has accepted the terms offered by the Secretary of State, and it hopes it will be able to persuade him that no charge shall be made for interest on the loan during construction.

Relations With the Government

At this point I should like to emphasize the extreme importance to the future success of this company that it should always have the confidence and support of the government of India and the Secretary of State. At all stages of the operations in Burma we often require government assistance and good will, and I will ask you to appreciate the position of the government of India—the landlord and owner of our mineral rights—as owning and controlling the Burma railway system and as possessing authority to deal with all local conditions. As illustrating the necessity for securing the confidence of that government, I will give you one or two instances. Although we have secured the support of the Burma Railways Co. to the construction by that company of a branch line to Namtu, this support is contingent on the approval of the government of India, which owns the Burma railways, and leases them to the company to work, sanctioning the construction of the branch and providing the railway company with money to build it.

Again, during the war, without the assistance of the

Indian government, we could not have produced lead or silver, as it was impossible to obtain coke in the quantity required, and such tonnage as we might have secured would have been at an exorbitant price. With government aid we obtained the coke we wanted at a price we could afford to pay. As illustrating the help the government can give us in local matters, I may say that the water rights in the Mansam waterfalls belong to one of the local chieftains. With the assistance of the government of Burma, we were able to make reasonable terms with the owner of these water rights, the final agreement being that for the first five years we pay nothing for the use of the rights, for the second five years we are to pay £1000 a year, and for the rest of the period £2000 a year. Incidentally I would remark that the local government of Burma is also our good friend in many matters, and is charging us half the usual rates of royalty on the timber and wood fuel we obtain from the government forests.

Mr. Addicks' Investigation of the Burma Ores

Turning again to the action taken toward the establishment of the zinc works in India: Anticipating that the government of India's reply would be satisfactory, the board, at the end of 1917, deputed Lawrence Addicks, who at the present time is our consulting engineer, to proceed to India and Burma to report specially on the proposed zinc works, as well as to investigate generally the metallurgical position at the mines. Careful inquiry was made before the selection of Mr. Addicks to undertake this important mission was decided on, and I am glad to think that his selection met the entire approval of H. C. Hoover, who was consulted in relation to the appointment.

The work Mr. Addicks did in India and Burma, and the clear and precise reports which he submitted, have fully justified the confidence of the board in his selection. His reports indicate a complete grasp of the magnitude of the problem of dealing with the Burma ores, and his recommendations were sound in every way. After careful investigation and study in India in the early part of 1918, Mr. Addicks advised the erection at once of the zinc-smelting plant at Sakchi, India, capable of dealing with 25,000 tons of zinc concentrates per annum. Sakchi, I would mention, is the place where the Tata Iron and Steel Works are situated, these works being of great magnitude. The designing of the zinc works has been intrusted to Mr. Addicks. He has had the advantage of studying, on the spot, the local conditions affecting the working of the plant. On his return from India, in the spring of 1918, he visited important zinc-smelting works in England and discussed with leading experts the features of the design of a plant which would be most applicable to Indian conditions. He further has an extensive practical knowledge of American methods of dealing with ores of a character akin to those of Burma. We believe we have in Mr. Addicks an adviser in whom full confidence can be placed, and, from my long experience in India, I have every confidence that Indian labor will be found very suitable for zinc-smelting work.

I have visited zinc-smelting works in England, and see no reason why the labor part of the work cannot be efficiently carried out by Indians, or why it should be beyond their capacity. The Indian workman of the good class obtainable can be trained to do any work required. He is apt in picking up new kinds of work if trouble and patience are taken to teach him; and, having once mastered his particular job, he works at it like a machine, however monotonous it may be. I have seen many instances of the way in which Indians learn new trades with success, and will give you one example. Previous to the installation of the Tata Steel Works, at Sakchi, the manufacture of high-class and reliable steel in large tonnage in India was unknown. When these steel works were first started, a large contingent of white trained labor was employed. Today, this white contingent has been mainly replaced by Indian labor, all trained by the steel-works staff. With raw material at no great distance, with cheap coal and reliable cheap labor, there seems to be every reason why the promotion of zinc-smelting works in India should be a financial success. There will be a ready sale to the Tata Steel Works for a great deal of the spelter and acid which the works will produce, and negotiations with the steel works for such an arrangement are well advanced.

Statistics obtained by Mr. Addicks when in India show that, in the two years before the war, imports of spelter were 7745 and 9965 tons, respectively, these figures being exclusive of the requirement of the Tata Steel Works, which is a new demand. Our anticipated output of spelter from the works of the size planned will be about 10,000 tons.

Industrial Development in India

That India is at the beginning of a period of extensive industrial development is certain. The Indian Industrial Commission has recently issued its report, and I understand that one of its recommendations is the creation of an industrial department of the government of India whose special function will be the development of Indian industries. The department will be represented by a board of three members, the president of which is to have a seat on the Viceroy's Executive Council. In this industrial development there should be a wide field for the increased use of spelter and sulphuric acid. It is therefore entirely possible that the future may justify a large expansion of zinc smelting in India, and lead to the absorption of large tonnage of our zinc concentrates, particularly when it is recollected that Indian conditions, especially labor, lead one to think that it will be possible to make spelter in India at a cheaper cost than in other countries.

We are now on the eve of a new period in the history and development of this company. The early history of the Bawdwin mines, up to the year 1914, was most disappointing, and it was not until the Burma Corporation was formed, to provide a supply of the much-needed capital, that prospects improved. Then the war ensued, with the many difficulties it created and the anxieties that it caused; and I think the progress which has been made is a matter for congratulation.

Gratitude to H. C. Hoover

This company owes a great debt of gratitude to H. C. Hoover for his work in laying the foundation of success. To him and to the technical committee we owe the bold conception of the Tiger Tunnel and the ideas

on which our mining policy should be based. We also owe a great deal to our consulting engineer and to our staff in Burma, who have been working under adverse circumstances during the last four years. We start the new period before us with our finances in a sound condition, with a fuller knowledge of the metallurgy of our ore, and with the full support and sympathy of the government of India. The prospect ahead is a bright one, and although difficult problems of detail have still to be finally solved, there is no reason to apprehend that these difficulties will be insurmountable.

Mobility of Gold in Solid State*

By Edward Keller

Some years ago my attention was called to the fact that rolling-mill scales from auriferous copper do not have the gold tenor proportional to the gold contained in the copper from which they are derived. So, later, I made a few simple experiments, which are described herewith.

To test the gold movement on the changing surface of a copper plate under the influence of oxidation, plates 6 in. by 8 in. by 1 in., of converter copper, refined, of 99.29% purity, and leaded copper with a tenor of 95.65% copper, were obtained. Ten cuts were made through the thickness of the plates along the longitudinal center, and the silver and gold tenor ascertained in each of the 10 samples in both plates. The assay results showed that the gold distribution is relatively uniform in both plates, whereas silver has greater variations, especially in the leaded plate. The plates subjected to oxidation were placed in a red-hot muffle for about two hours, two small scorifiers being used as supports. Arranged alongside each other, they nearly filled the width of the muffle, and so were practically under equal conditions of heat and draft. The accurate observance of the time was not possible, however, because of other work, but the time of the exposure of each plate in a pair was identical. At the end of each period, each plate was plunged into water and completely freed of scale, which was carefully collected, dried, weighed, and analyzed. Samples of the plates had also been taken of the molten metal and duly analyzed.

The figures showed that in the oxidations of the converter copper the silver is fairly uniform, whereas the gold is highly irregular and especially low in the first layer. In the oxidations of the leaded copper plate, the silver and gold contents are variable.

What has been proved of the gold movement toward the residual plates should also be proved by the analyses of the plates themselves. However, these residual plates, which were approximately ¼ in. thick, had samples planed from the top and bottom surfaces, and these, as also a sample from the finally remaining plate, were analyzed, but the weights of the respective parts were not taken, and a proper average of the assays cannot be given.

Most of the converter copper now shipped from the smelteries in the form of anodes and bars is subjected to the so-called pickling process; that is, the red-hot castings are plunged into water, in which they shed most of the oxide scales that have formed on their surface. That these scales have by far the greater part of the gold that was contained in the copper has been conclusively proved. No data available show the commercial magnitude of this problem, but the first layer of scales in the oxidation of the experimental converter copper plate may, perhaps, be an index of what takes place on a larger scale in metallurgical practice. The original plate was not weighed, but from its dimensions, 6 in. by 8 in. by 1 in., and the assay results the following data and conclusions are obtainable:

Weight of original plate, lb.	14.4
Weight of copper in first oxide scales (365.4 oz.), lb.	0.8
Weight of remaining plate, lb.	13.6
Gold in original plate, oz. per ton	0.315
Gold in copper of first oxide scales, oz. per ton	0.046
Weight of gold in original plate, oz.	0.002268
Weight of gold in first oxide scales, oz.	0.000018
Weight of gold in remaining plate, oz.	0.002250
Gold in remaining plate, oz. per ton	0.331
Gold in original plate, oz. per ton	0.315
Enrichment of remaining plate, oz. per ton	0.016 =5.08%

This last figure, of course, will decrease with the increase of the thickness and weight of the plates or with the decrease in the thickness of the layer of oxidized copper. In the latter case, however, the scales would become poorer in gold, which would relatively increase the enrichment of the remaining plate.

It is generally known that in silver-gold alloys the silver is soluble in nitric acid when the alloy contains about 30% or less of gold, and that in the higher grade of alloys comparatively strong nitric acid may be used without disintegrating the gold. As the gold content decreases and nitric acid above a certain strength is used, disintegration will take place. However, for the whole series of alloys down to 1% or even less of gold, a proper strength of nitric acid and heat will dissolve the silver and leave the gold in such a coherent state that it represents the exact shape of the original bead, although very much reduced in size when little gold is present. Therefore it may be said that, with decreasing gold content in the silver-gold bead, the more marked will be the gold movement in the direction of the retreating surface of the silver under the solvent action of the nitric acid.

The assay silver-gold beads derived from the greater part of the converter copper now produced contain about 1% of gold. Unless the gold is obtained in coherent form in the parting operation, there are almost unavoidable losses in the decanting manipulations and there is a resultant low gold assay. For example, when such low-grade assay beads are left in cold dilute nitric acid, nine parts water to one part nitric acid (sp.gr. 1.42), until all the silver is dissolved, the gold will be completely disintegrated. The same dilute nitric acid is the best solvent for preserving the gold in the desired state, when it is brought to the temperature of boiling water as quickly as possible after the assay bead is immersed. The higher temperature evidently increases the gold mobility.

Silver-gold assay beads derived from silver chloride and metallic gold by the customary operations of scorification and cupellation have a silver fineness, after deduction of the gold, of 996 to 998.5 per thousand.

Titrations and analyses have confirmed these figures. An analysis of 30 gm. of such beads showed them to

*Abstract from a paper to be presented at the New York meeting of the A. I. M. E., February, 1919.

contain 0.16% lead and 0.15% bismuth, the latter metal having concentrated in the silver from the test lead, which at the time contained approximately 0.02% of that metal. Assay beads of not less than 997 silver fineness offer no difficulty in the gold assay, but when the silver falls to 990 or lower the gold cannot be obtained in any other form than powder, no matter what acid and heat combinations are employed.

Much difficulty was formerly encountered in obtaining concordant results for silver and gold in the assay of the same sample of copper-anode residues by the all-fire method. There were always disagreements, reading, "high silver, low gold" or "low silver, high gold." As the pyrometer has not been introduced in the assay muffle, it is impossible to give the terms "hot" and "cool" in degrees of temperature. By the term "hot" is meant a temperature that will keep the slag in the scorifiers thoroughly liquid and will prevent the formation of lead oxide crystals (feathers) in the cupels. By "cool" is meant a temperature that keeps the slag molten but permits the profuse formation of crystals in the cupels. Tests showed that, with the higher temperature, a considerable portion of the silver was not recoverable; that is, it was volatilized, whereas at the lower temperature impurities to the extent of 16.22 oz. were retained by the assay beads. Supposing the beads that yielded the result of 3750 oz. to be of 998 fineness, those that gave 3766 oz. should be 993.8 fine. Results showed that, in the gold assay of the beads of the latter character, considerable gold passes into the decantation liquid, owing to disintegration; and that it is three times as great as that from the beads obtained in the hotter operations, and which, therefore, are purer. This decanted gold is not visible, ordinarily, and is not recovered in commercial work. It is best collected by the precipitation of a certain quantity of silver chloride, filtration, and subsequent operations. A gradation occurs in the degree of the gold disintegration, from its almost complete cohesion, when derived from silver beads of 998 fineness, to its pulverulent form when derived from beads of, perhaps, 990 fineness.

A scientific examination of the causes of these differences has not been made. It is a generally accepted theory that the whole silver-gold alloy series form solid solutions in which the two metals are, to a certain extent, in a state of continuity, their molecules remaining within spheres of mutual attraction. It may readily be imagined that impurities forming compounds of eutectic mixtures may be so interspersed in the alloy as to disrupt the continuity of the gold and to destroy its cohesive property. Or, certain impurities may form chemical compounds with the gold itself, which would no longer have the properties of the metal, but would leave it in a finely divided metallic state upon the action of the nitric acid.

Zinc Smelting at Saltillo, Mexico

The International Zinc Ore Co. is building a zinc smeltery at Saltillo, Mexico, but owing to the great difficulty in obtaining material and machinery from the United States in 1918, construction had to be interrupted last June. The company is building two Belgian distilling furnaces of 300 retorts each, which will be fired with petroleum. It has completed an eight-grate furnace to make zinc oxide direct from ore.

At present the company is confining itself to blende roasting, shipping the product to American smelters.

Construction of the plant will be resumed this year. Some interesting photographs on pages 360 and 361 of this issue will give a good idea of what has been done already. Among other things will be noticed an experimental distilling furnace of 30 retorts. This is claimed to be the first zinc-distilling furnace built anywhere in Latin America. We have no doubt that the claim is correct.

British Imports and Exports

The following figures of British metal imports and exports have been reported by the Board of Trade, and published in the *Ironmonger*, of Jan. 11, 1919:

BRITISH IMPORTS
(In Long Tons)

Metals	1917	1918
Pig iron, basic	48,076	62,831
Pig iron, forge, foundry	75,547	29,889
Pig iron, hematite	17,863	11,642
Pig iron, other grades	13,640	24,992
Steel blooms, etc	58,402	20,046
Iron bars, angles, rods	28,270	15,082
Copper regulus	28,238	21,031
Copper, unwrought and part wrought	142,778	203,943
Lead, pig and sheet	147,124	208,932
Tin, blocks, ingots, etc	27,143	12,567
Zinc, crude	76,105	64,138
Zinc, manufactured	4,105	3,023

BRITISH EXPORTS
(In Long Tons)

Metals and Ores	1917	1918
Pig iron, total	733,758	483,140
Basic	10,570	12,319
Forge and foundry	326,994	242,406
Hematite	301,717	162,136
Other grades	94,477	66,279
Iron ore	667	160
Copper total	10,159	7,255
Ingots, etc	5,177	4,034
Yellow and mixed	464	223
Manufactures of	3,417	2,482
Lead, pigs, etc	9,364	4,910
Tin, unwrought	19,265	15,251
Zinc and spelter	7,804	1,383

Excessive Areas in Placer Claims

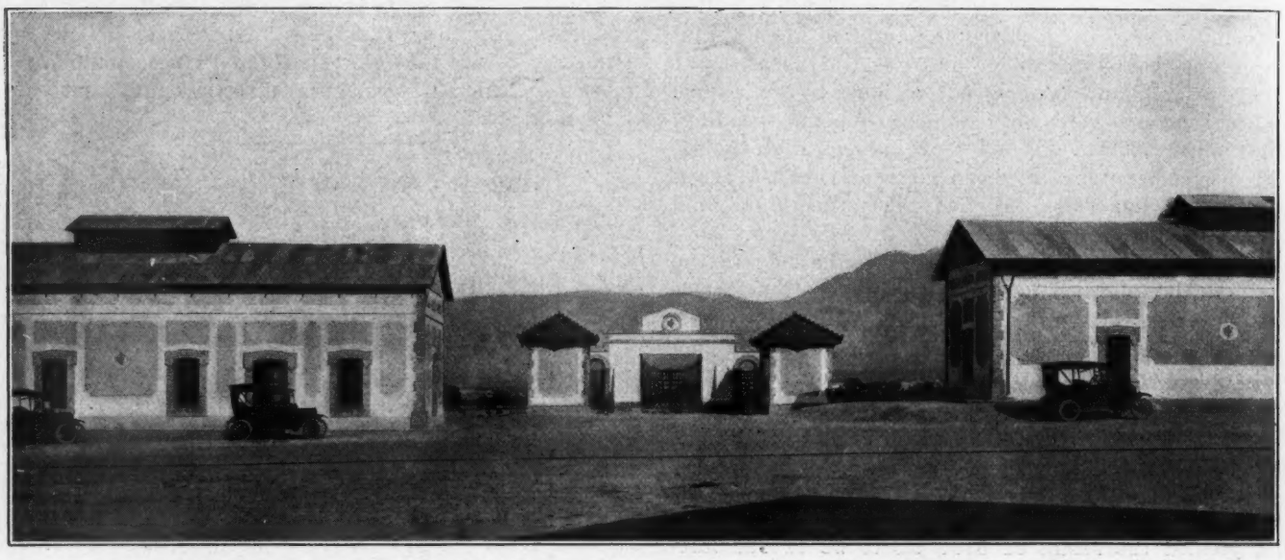
BY A. L. H. STREET*

A location of a placer claim made in good faith, but by mistake containing an excessive area, is not wholly void, holds the United States Circuit Court of Appeals, Ninth Circuit, in the recent case of Adams *vs.* Yukon Gold Co. (*251 Federal Reporter, 226*), a suit brought to quiet title to placer properties on Otter Creek, Alaska. Such a location is invalid only as to the excess area, which may be rejected from such portion as the owner may select; and until the owner is advised that there is an excess, and has had reasonable time within which to make his selection, his possession extends to the entire claim. Anyone who goes upon it and makes another location becomes a trespasser, and such relocation is, according to the decision of the court, void.

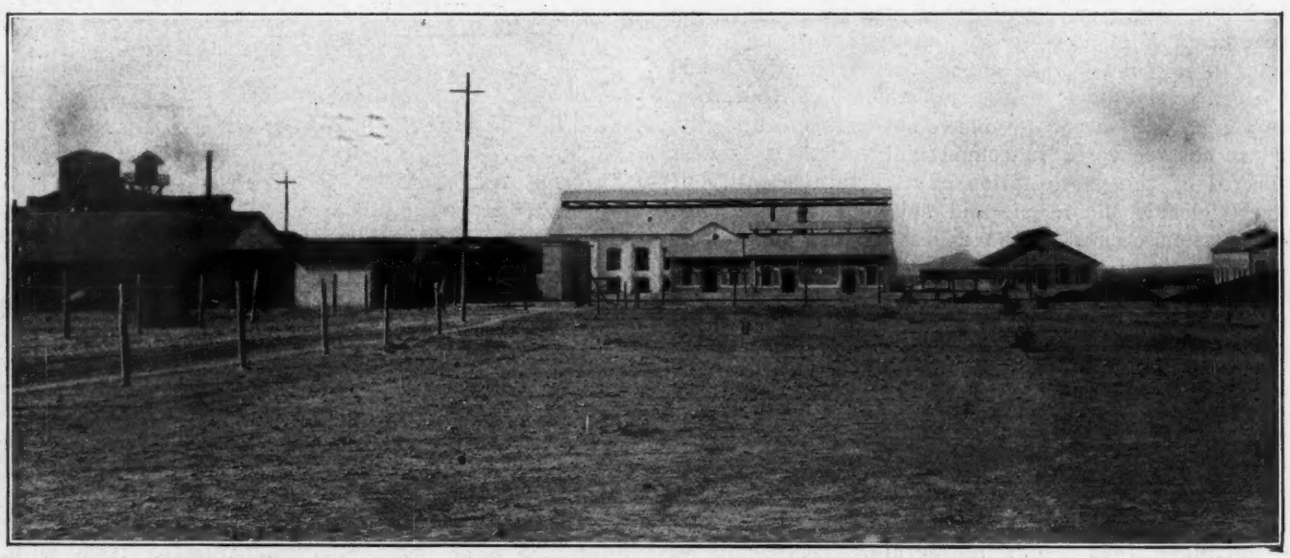
Incidentally, it is decided by the court that, where a claim is owned by two or more persons in undivided interests, one of them is not bound by the act of his associate or associates in unauthorizedly consenting to a relocation of part of the claim by an outsider, or agreeing to any other attempted disposition of the joint property.

*Attorney at law, 820 Security Bldg., Minneapolis, Minnesota.

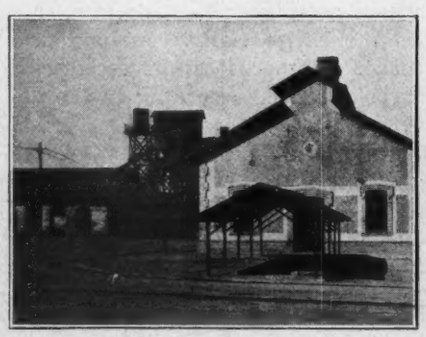
International Ore Co., Saltillo, Mexico



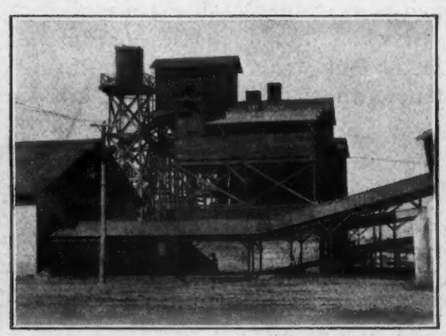
MAIN ENTRANCE TO PLANT OF INTERNATIONAL ORE CO. AT SALTILLO, MEXICO



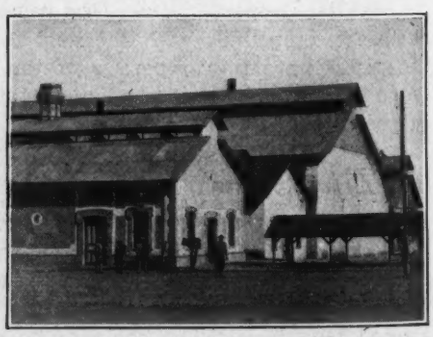
GENERAL VIEW OF CALCINING AND SMELTING PLANT OF INTERNATIONAL ORE COMPANY



SHAFT FURNACE

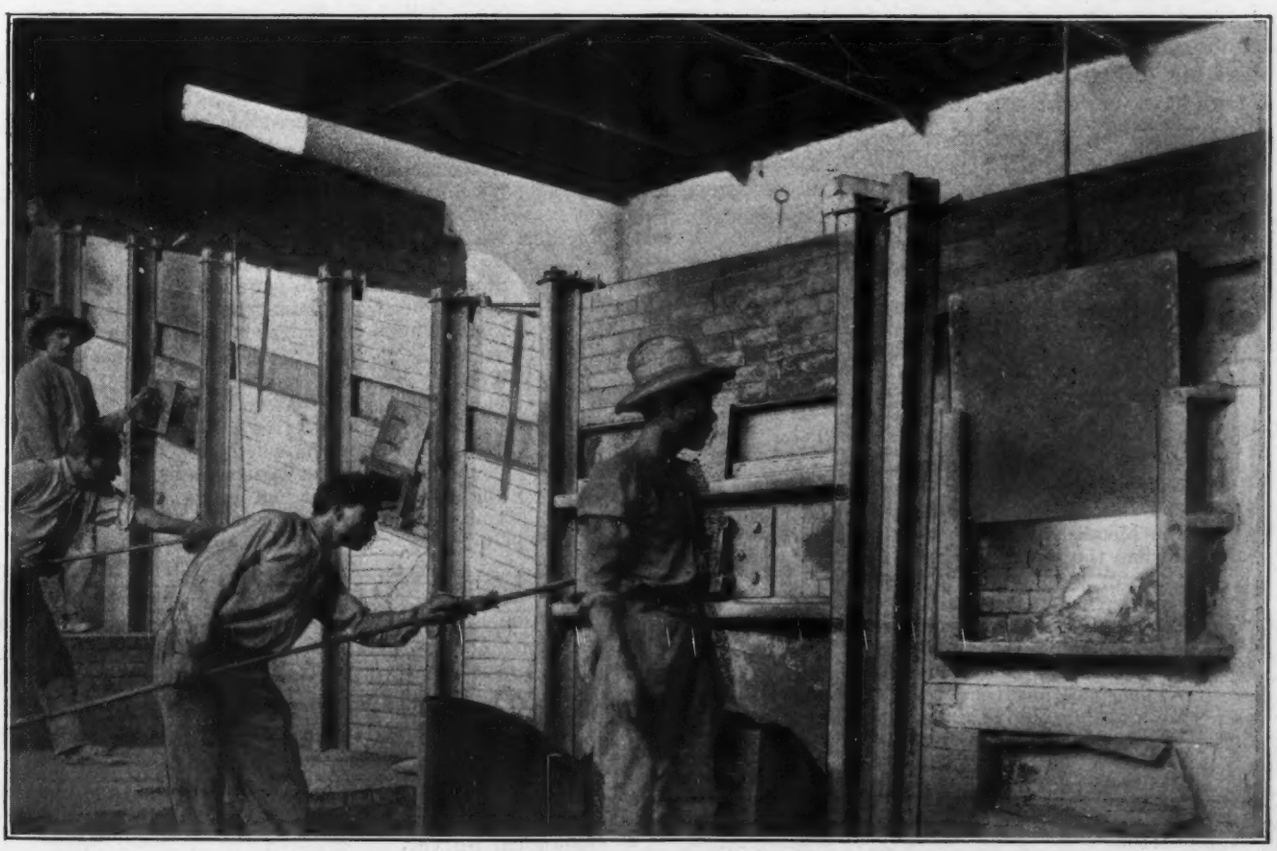


CALCINING PLANT



DISTILLING PLANT

FIRST ZINC-DISTILLATION FURNACE IN LATIN AMERICA AT PLANT OF INTERNATIONAL ORE COMPANY



REVERBERATORY FURNACES FOR CALCINING FINE ORE AT SALTILLO, MEXICO

An Appreciation of Rossiter W. Raymond

By E. S. BOALICH*

WHEN Clarence King laid aside his earthly cares, Raymond said "The King is dead—and there is none to take his place." Raymond now has gone, and not only is there none to take his place, but who is there to tell of his passing as he has chronicled the falling of the curtain on the lives of his friends for more than fifty years?

Raymond was an intimate of the majority of those engaged in all branches of mining almost since the beginning of that industry in the United States. He was a scientist, an engineer, an editor, a writer, a soldier, a lawyer, an orator, and a poet. His friendship must have been priceless to those who knew him. I saw him but once—at a distance—during the Pan-American Scientific Congress in Washington, D. C., in December, 1915. But I have read his obituaries—his farewells to the friends of his youth—written as these men, one by one, dropped out of the race which he continued to run, even beyond the allotted span of threescore years and ten. A volume containing these obituaries would make a "human" document unequaled in literature, and it would comprise a real and fascinating history of mining and metallurgy in America, as well.

And I have read his poems—some of them; and some of his editorials; and many of his accounts of Western travel, when the West *was* West. I have today a feeling of personal loss so strong that I am almost glad I was denied the pleasure of actually knowing him.

Whether discussing the law of the apex, or presiding at the laying of a cornerstone, his buoyancy and optimism and wit and wisdom simply seemed to bubble to the surface and permeate all the fabric of either the carefully drawn document or the extemporaneous speech. Many have viewed the great cross-section of the earth's crust which is revealed at the Grand Canyon of the Colorado; it has been "written up" by great and small; but what poet could have more aptly and reverently set down his impressions than did Dr. Raymond in the following?

THE GRAND CANON (1889)

A thought of God, on earth expressed!
The silence of His perfect rest;
The patience of eternal power;
The ceaseless change from hour to hour;
Forms in alternate gloom and flame
That bide, yet evermore the same,
And do but wear such fitful guise
Reflected in our human eyes,
Which compass only in their range
The things that change, or seem to change;
The blended hues of heavenly birth
Beyond the tenderest tints of earth,
That fill and flood her spaces wide
With surges of celestial tide;
The beauty of that awful brink
Where meaner thoughts in rapture sink,
And souls are clear, though eyes grow dim
While space and time are lost in Him!
Methinks I could not faint or flee
In any conflict yet to be,
Whatever pathway must be trod;
May I but keep this thought of God!

To what miner, or smelter, or engineer has been vouchsafed the gift of describing his chosen labor as Raymond did in the following toast "To Ourselves," written for a banquet of the American Institute of Engineers in 1880?

Beside a thousand turbid streams
We follow where the treasure gleams,
The onset of our mighty hose
Disturbs from ages of repose
The rocky guardians of the gold
Left by the refugees of old,
When rivers hastened, sore bestead,
And dropped their jewels as they fled.

Beneath the everlasting snow
Of stainless summits, blow on blow
We smite and delve; we pierce and blast
Along Earth's veins, until at last
The sleeping mountains, long at rest,
Dream troubled dreams, and tremble lest
With inward throes that shake and burn,
Old geologic pangs return.

There for a while, reluctantly
The shore surrendered to the sea,
And when, anon with sullen roar
The sea retreated from the shore,
And great fern forests lived and died
To mark the battle's changing tide—
Their tombs we spoil, to bear away
The sunshine of an elder day.

What wakes the echoes of the hills?
The clangor of our stamping-mills.
What paints the sky with midnight reds?
The flaming of our tunnel heads.
The blinking, blasting breath that slips
Through fierce converters' bellowing lips,
The fiery snakes, that to and fro,
Among the roll-trains glide and glow.

Ho! merchants in the city's din,
We find the coin you strive to win.
Ho! sturdy growers of the grain,
We help you till the fertile plain.
Ho! gallant sailors of the sea,
Staunch comrades in your toil are we;
Behold our work from mast to keel,
In iron hulls and shrouds of steel.

We hail in every rank of art
The earnest souls that do their part;
Yet not to any lower the crest
Of that we deem the worthiest:
The arts which first of arts began!
The art which most has wrought for man!
And we will greet with loudest cheers
Ourselves—the Mining Engineers!

On Feb. 22, 1868, Dr. Raymond published the following "Dog-Eat-Doggerel Ballad," which touches neither the heart not the head to any great degree, yet reveals a distinct side of the character of the young "Ph.D." (of 28), who had about four years previously founded the weekly technical magazine which was soon after named the *Engineering and Mining Journal;* and the man who was at that time U. S. Mining Commissioner and had begun the work now carried on by the U. S. Geological Survey.

*Mining engineer, California State Mining Bureau, San Francisco, California.

JIM GREEN

There was a man, Jim Green by name, he struck a ledge and staked a claim;
Then came to town by the overland bus, and corraled a scientific cuss.

"Professor, I would like to sport an assay and a swell report;
I want you to crack up my rock and take your dividend in stock."
The swell report was quickly done, the ledge it was a fissure one;
Quite well defined; and the ore it run a thousand dollars to the ton.

Then Jim he got a brand new hat (the trader wouldn't take stock for that!)
And started, one of the steamer days, to sell in New York, and make a raise.

He mounted all his handsome things—two California diamond rings—
And a nugget breast pin on his shirt shed golden lustre o'er the dirt.

He landed, and to Wall Street went, and there he found a nice old gent;
So Jim laid out to do his best, and talked him till he couldn't rest.

"Your h'ain't got no notion how great," says he, "Our mineral resources be;
Jest one per cent of what we get will pay this whole damn national debt.

"There ain't a better cow to milk than a first class mine (that ain't a bilk);
She'll give you quartz"—and here he cussed—"If that ain't level then bust my crust."

The nice old gent he was no clam, he had served a while with Uncle Sam,
And what he hadn't found out yet was mighty poor tailings, now you bet.

So this old capital sharp told James that he often bought these first-class claims
And if he froze to any feller it was a mineral-property seller.

Then just to grease the bargain, Jim made out a quit claim deed to him,
And, as a matter of form, agreed to name one million in the deed.

In thirty days the thing was done, and when Jim figured what he'd won,
He felt as cheap as a Yankee clock;—Ten whiskey straights, *and the rest in stock.*

The stock he had promised not to sell—(how it happened he couldn't tell—
He signed the documents in haste) until the company's stock was placed.

There was a board of rich trustees, (a stock donation to each of these)
And they sold the shares on terms to please, to twenty widows and ten D.D.'s.

A brigadier was president, the treasurer was the Wall Street gent,
And for economy it was agreed the treasurer only should be fee'd.

When Jim Green's turn to sell came round, there was nary buyer to be found;
And the treasurer kindly did advise to hold his stock till it should rise.

"Look here," said Jim; "this thing's a sham, I'm told your stock ain't worth a damn!"
"My friend! in mining operations there always are these fluctuations."

As time eloped they failed to get the process for the sulphuret,
And ere they solved that fatal doubt the blasted ledge had petered out!

The trustees all did abdicate; the clergy preached man's lost estate;
The treasurer took a foreign tour; the widows! heaven protect the poor!

Jim Green upon a marble white his name and this "dead broke" did write;
Then lay down in an onion bed and pulled the tombstone o'er his head.

Though my knowledge of Dr. Raymond has been gained entirely through his writings, I think of him as being possessed of a soul such as that revealed, in part, at least, in the letter written at the death of Justus Adelberg, his friend and business partner, who died in 1869. This letter, dated Central City, Colorado, June 14 of that year, says in part:

> In a world which gives little credit for difficulties overcome and measures men by their success, he achieved an honorable fame. He carried a heavy weight, yet did not fall behind his competitors in the race. Such examples put to shame the indolence and indifference of those who, blest with health and strength, accomplish nothing . . . yet as I sit alone by midnight, in a strange city, and muse over this bereavement, I think not of his genius and learning, but of his noble soul. Others have lost in him the keen observer, the brilliant thinker, the pleasant acquaintance, the hospitable host; but to me he was all this and a thousand times more. He was my wise kind teacher, my upright partner; my dear, true friend.
>
> Finally, Justus Adelberg was not one of those modern philosophers who sneer at religion or coldly argue away the foundations of spiritual life. Through many conflicts from which less independent minds are exempt, he held fast his faith in God, and was not ashamed to avow it. In the same faith, looking for the resurrection of the dead and the life of the world to come, I lay upon his grave this tribute of my love. His deliverance and gain are great; my loss is not for long.

Mining Conditions in South Africa

BY E. M. WESTON

The South African mining industry, in the middle of 1918, was in a critical position. The factors affecting the position had been (1) the rise in cost of supplies, (2) shortage of glycerin for explosives, (3) high wages paid to white labor and allowances to dependent soldiers, (4) increased realization charges on gold, (5) increased taxation, and (6) shortage of native labor. The industry now is threatened with increased provincial taxation on profits and with still further increases of wages demanded by white and native labor. The rise in working costs is illustrated in the case of the Crown Mines, Ltd., as shown herewith:

COSTS AT CROWN MINES, LTD.

Year	Development Footage	Tons Milled	Working Costs Per Ton s.	d.
1914	2,725	190,583	15	7
1915	4,025	208,083	16	1
1916	4,540	188,833	18	3
1917	3,008	175,000	19	3
1918	2,081	162,400	21	9

From August, 1914, to May, 1918, the war has caused this company an extra expenditure of £847,360, made up as follows: Increased cost of mine supplies, £387,000; increased wages to Europeans, £129,099; war bonuses,

£46,555; allowance to employees on active service, £54,644; increased gold realization charges, £124,994; war levy by South African government, £105,068. The working costs for 1918 increased 4s. per ton as compared with 1914. This has involved the mines of the Witwatersrand in an additional cost of £5,100,000 per annum, or 3s. 8d. per ton milled.

On the Crown Mines, white wages, in 1914, were 4s. per ton milled; in 1918, 5s. 8.9d. Stores, 4s. 8.8d., increased to 6s. 8.3d. Other costs, 2s. 9.5d., increased to 3s. 11.5d. The average monthly earnings of skilled laborers increased from £27 12s. to £31 15s. The Crown Mines contributed £214,745 and the whole industry spent £2,850,012 on phthisis prevention and treatment during the five years ending July 31, 1917.

In August, 1918, owing to the rapidly advancing cost of living, the Chamber of Mines agreed to increase the war bonus to mine employees to an amount that will cost the industry another £750,000 per year, or 7d. per ton milled. The native workers in the mines have been showing signs of restlessness, owing to the spread of education and the rise in prices in the stores of the mines. An abortive strike took place and a demand was made for a wage increase of 1s. a day. An increase of only 3d. would cost the industry £750,000 per year. Although the natives have been quieted by the appointment of a commissioner to inquire into their grievances, a number, especially those living near the towns, are suffering hardships. Native mine workers' wages average 2s. per shift, and food, housing, and medical treatment cost, in addition, 7d. per shift. A successful attempt to inoculate natives against pneumonia has effected a great decrease in the death rate, which, at the Crown Mines, was 7.37 per 1000 in 1910 and 2.95 in 1918. At the Premier Diamond mine, which is worked by open-cut methods, pneumonia was formerly a terrible scourge, the death rate in 1910 being 28.97. From November, 1916, to October, 1917, 10,507 newly recruited natives were inoculated, and the death rate dropped to 0.86 per 1000.

At the De Beers diamond mine the underground death rate from pneumonia was 19.27 per 1000 in 1910. From May to October, 1917, statistics indicate that 6466 natives were inoculated, and of these only one died. The total mortality rate at the mines of the Witwatersrand is now 13 per 1000. The production of gold for the first eight months ended August, 1918, was valued at £23,667,542, the corresponding period of 1917, £24,983,236. Working costs have risen £408,698 and working profits have decreased £1,623,896. Of the 49 producing companies, six show a working monthly loss, and 15 others show a small profit. Capital expenditures, debenture debt, phthisis compensation, and other charges, however, convert this into a loss. These figures show the serious position of the industry. The mines now being developed in the Far East Rand cannot be brought to a productive stage in time to take the places of those whose life is expiring, and considerable reduction in the gold output may be expected.

The report of the government mining engineer, Sir Robert Kolze, shows that for 1917 the value of the mineral output of the Union of South Africa was £52,260,190, an increase of £1,666,831, compared with 1916. Gold output amounted to £38,307,675, showing a decrease of £1,183,315 compared with 1916. The diamond, coal, silver, and lime output showed an increase. The copper output showed a decline, owing to the falling in grade of the ore mined at the Messina mine, which shows signs of exhaustion, and the lower-grade ore treated in the Namaqualand mines of the Cape Copper Company.

Nationalizing the Oil Industry

Speaking at the recent meeting of the American Mining Congress, D. M. Folson said:

"To my mind there are many good reasons why the Government should not attempt the nationalization of any industry; but I shall only mention two reasons. To begin with, I question the possibility of Government success in the actual operation of any industry as many-sided and as sensitive as the oil industry. Nothing that the Government has done, either before the war or during the war, has indicated that Uncle Sam is a good business manager or even a fair success as an industrial executive.

"America has developed as a nation of pioneers. The frontier line has never quite faded away, and the race which has grown up on this continent has acquired its character and its liberty of action and its self-reliance as a result of the free opportunity given to the individual. This is so fundamental that I emphasize it here only because of the socialistic winds which blow through the world. The will-of-the-wisp of nationalism, of paternalism, and of public ownership may tempt the dreamers and inspire the demagogue even in our own country—but in their elusive visions of a Utopia the dreamers forget that the human race has risen from the Stone Age through the acquisition of property and the human quality of selfishness. All human experience and all human wisdom point to national development through the opportunity for development given to individual initiative.

"In the past, each industry which has attempted to secure favorable legislation from Congress has had to work alone. The result has been that each industry has immediately and directly been accused of lobbying to its own interest and has been discredited before the committees of the national Congress in every attempt to obtain relief or justice from the legislative branch of the Federal Government. In turn, various groups of mining men, representing companies producing certain metals; attorneys for oil companies, and executives of power companies have appeared in Washington, and have carefully and patiently explained to various committees the need of constructive legislation, and in regular rotation bills have been introduced in one or both houses of Congress, only to die in committee or in conference. From time to time promises of legislation have been made, and Presidential messages have been written, in regard to the development of power and the release of withdrawn lands. But the temporary withdrawals still stand, and the producer of power from water and the producer of power from oil are both prevented from developing the resources of the nation. This policy of repression was inconsistent and unfair before the war. It was almost fatal to the prosecution of the war, and if continued will certainly be fatal to the development of a national constructive program for peace."

Correspondence and Discussion

Replacing Oliver-Filter Shafts

With reference to the article published in the *Journal* of Nov. 9, 1918, concerning the replacing of Oliver-filter shafts, the method described was soon improved. The pipe used was 2½ in., and the shaft (pieces of the original Oliver-filter shaft) 2 7/16 in. As there was 1/16 in. of play between shaft and the pipe, the pulp worked in between, and ground the shaft and pipe seriously, the pin acting as a pivot. After short service the pipe worked so loose that no satisfactory packing could be held in the packing boxes.

The improvements made were to use a piece of shafting about 8 in. long, with a pipe on each end, bolted together with two ⅝-in. bolts and with lock washers. The paddle blades were bolted to the pipe, and, so as to make it possible to get at them easily from the side of the filter; the manhole was enlarged to 18 x 12 in. Inside the stuffing boxes on each side next to the pulp a cast-iron bushing ¾ in. long was placed. This fits snugly inside the box and loosely (1/64 in. clearance.) on the shaft. When worn down ⅛ in. they are exchanged for new ones, and thus save the wear on the boxes, keep the shaft in the center, and are a great help in keeping the packing in the most satisfactory condition. Gland water cannot be used, but by using grease, in compression cups, the service is good. CHAS. LABBE.

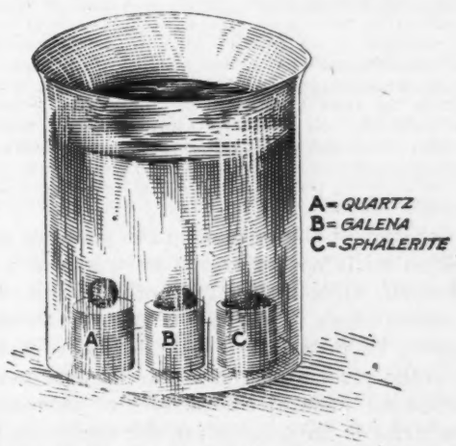
Nelson, Nev., Dec. 15, 1918.

Flocculation in Flotation

In an article which appeared in the *Journal* of Dec. 28, 1918, on "Why Minerals Float," George J. Young ventures the hypothesis "that before a froth can be formed it is necessary to have conditions present that will permit of the flocculation of the mineral particles," such conditions being brought about by the "addition of an electrolyte." He fortifies this statement with the following experiment: "Suspend 50 gm. of finely crushed galena in 5000 c.c. of water rendered alkaline with 25 gm. caustic soda, and maintain it in suspension by vigorous agitation in one part of the vessel. Now add some flotation agent. No froth will form. Gradually acidify the solution. As soon as acidity is reached, a froth will appear and rise to the surface in the quieter portions of the vessel." In describing this experiment he states that "agitation and oil failed to produce a froth, but as soon as an electrolyte was added a froth appeared."

From the above experiment it is evident that the author has overlooked the fact that sodium hydroxide is a strong electrolyte, being almost completely ionized at the dilution of the experiment. No mention is made of the kind or quantity of the frothing agent used in the experiment quoted. Some frothing agents, when used in alkaline water, possess the property of forming what might be called "permanent emulsions," in which state they are not active for froth formation. When such a condition exists, the addition of sulphuric acid will break the emulsion and free the reagent, thus bringing it into such condition that it will form a froth. It is probable that this condition existed in the experiment described by Mr. Young. Although data were lacking with which to duplicate this, we have carried out the following test along somewhat similar lines: An amount equaling 250 gm. of a mixture of 45% galena and 55% quartz was agitated with 1250 c.c. distilled water rendered alkaline with 4 gm. of sodium hydroxide. Upon the addition of 0.15 c.c. of an oil mixture (90% pine oil, 10% kerosene), a stable, mineral-bearing froth resulted. When the solution was acidified with sulphuric acid, a slightly more selective, less stable froth formed, but in smaller quantity.

It is true that acid is often beneficial in flotation, usually by the formation of a more selective froth. However, in many cases it is found to be detrimental to froth formation, and some ores give better results when an alkaline pulp is used.



POSITION TAKEN BY A DROP OF HEAVY TAR OIL WHEN PLACED ON VARIOUS MINERALS

Mr. Young's contention is to the effect that flocculation is necessary for froth formation, the floccules serving to trap and hold the globules of air with sufficient tenacity to cause a froth to form. If this condition existed, the mineral should appear as floccules in the bubble film of the froth. We have made careful microscopic examination of over 2000 mineral-bearing froths formed from a number of different ores and with a wide variety of frothing agents, and in few cases has there been noticeable any flocculation of the mineral. In practically all cases the mineral exists in the film in the form of distinct, individual particles.

The tendency of oil to displace either air or water is greater at the surface of sulphide particles than at the surface of gangue particles. When sufficient oil is used to cause cohesion of the sulphide particles, granulation will result under proper conditions. Such granu-

lation is detrimental to froth formation. It is possible, however, to form granules or froth with the same conditions as regards frothing agent, by a slight change in other conditions of the experiment.

It has been our experience that flocculation, which is incipient granulation, is detrimental to both froth formation and the recovery of the mineral; and that, whenever mineral floccules are apparent in the pulp, any change in the conditions of the experiment which tends to decrease the flocculation results in improvement in both froth formation and metal recovery.

As to the question of obscure chemical reactions between oil and oxygen adsorbed on the surface of the sulphide particles, the most striking argument against such a possibility is that flotation is easily explained by reference to well-known physical phenomena and without the aid of hypothetical, unlikely chemical reactions.

Further, many of the reagents used in the flotation process are not easily oxidized, and some are themselves oxidizing agents. We have carried out some elementary experiments, a description of one of which follows, with a view to studying the possibility of oil oxidation in its connection with sulphide oiling, but in all cases the results have tended to discredit the probability of such behavior.

A sample of a heavy tar oil (sp.gr. 1.14) was mixed for approximately one hour with a strong solution of potassium permanganate which had previously been acidified with sulphuric acid. The resulting mixture, which was rather viscous, was washed until free from permanganate. The washed viscous oil was then warmed to decrease its viscosity and dropped from a pipette onto galena, sphalerite, and quartz, which were immersed in water at approximately 60° C. The position taken by the oil are shown in the accompanying illustration. The positions taken by the non-oxidized oil were the same as those taken by the oxidized oil. That there might be additional oxidation of the treated oil by oxygen adsorbed on the surface of the sulphide is hardly to be expected, because of the strong oxidizing action of the permanganate solution.

This experiment shows that, in the presence of water, the oxidized oil is no better and no worse as a coating agent than the unoxidized oil; in other words, that oxidation, even though it might, by a large stretch of the imagination, be possible at the oil-solid contact, plays no part in the covering action. Further, the persistence of adsorbed air films at the surface of submerged sulphide particles is an assumption for which no proof is offered, and the presence of such films on the surface of particles ground under water, as is the case with flotation feeds, is even more unlikely.

C. C. SMITH,
A. R. PICKETT.

Hammond Laboratory, New Haven, Conn., Jan. 9, 1919.

International Money

Much discussion has been published on the subject of the "Gold Question," and many remedies have been suggested for the betterment of conditions for gold producers. The simplest argument, is, "Let well enough alone"; but the contention that present conditions are well enough is a debatable one. If what is called "business" is to persist in world life, then business certainly will adjust itself automatically to conditions; and the adjustment will begin to make itself noticed as soon as there is reasonable assurance that some of the conditions will remain fixed, or will at least follow some definite and logical law of change.

For example, if the I. W. W. miners at Butte announce that they must receive $6 for six hours' work each working day during March, and that for each successive month the pay must be increased 25c. per shift and the working period shortened by 15 min., then a simple calculation will show that they have dreams of getting $9 for three hours' work during the month of March, 1920. But before the year had passed the business of mining at Butte would have automatically adjusted itself, and the pay of I. W. W. miners would be zero dollars for zero hours of work.

The idea that the value or price of gold readjusted to $40 per oz., in place of the present U. S. Government price of $20.67 or $20.6718 per oz. (I believe that I was paid at the rate of $20.67 the last time I sold gold) certainly sounds interesting to one who has not made a life study of the higher phases of currency problems. To me it sounds like the reopening of many old mines, the search for gold and the discovery of mines capable of producing gold and other metals, and—well, it sounds like the stuff that dreams of prosperity are made of. Dreams are only dreams, but the old-fashioned American spirit used to make some dreams come true.

I recall that, when a youngster, I was much interested in a poem about one Darius Green and his flying machine. It was interesting to dream about flying, but our wise teacher (who had studied physics in a serious way for many years) told us that it simply could not be done. So when economists tell us that gold must remain at $20.67, or $20.6718, we should endeavor to forget that what we call a dollar today represents currency inflation, and dismiss the $40-per-ounce idea as a heavier-than-air dream.

In my dreamy way I have advocated that the proposed League of Nations take up the study of the $40-per-ounce idea, and at the same time consider the feasibility of establishing a fixed rate of exchange or the coinage of international money on a basis of:

One pound sterling = five dollars = 25 francs.

The idea is by no means original. At this time any objections from Germany may be ignored as unworthy of consideration. It would perhaps be a constructive and instructive aid for the *Journal* to reprint an editorial published in Vol. 25, May 25, 1878, p. 356, under the caption "International Money,"

WILLIAM B. MCKINLAY.

Yonkers, N. Y., Feb. 7, 1918.

Teaching Engineers Economics

The question as to what should be taught in a collegiate course in mining engineering comes up from time to time with the protests of some engineer who feels that something was wrong with the curriculum of his alma mater. These criticisms are undoubtedly earnest and sometimes constructive, but are so widely divergent in their recommendations that it is not surprising that they have so little effect. That which seems invaluable to a man of one experience seems a waste of time to another whose work has led him into a different field. It is probably true, as has been often pointed out, that the average American mining school tries to cover too wide a course, and neglects to provide a sufficient foundation in the fundamentals of science and engineering. In other words, the student, to his temporary satis-

faction, is given a vast amount of information, most of which he promptly forgets, instead of being taught to *think* along the lines of his profession.

Nevertheless it seems to the writer that the point taken by "Engineer" in his letter to the *Journal* of Nov. 9 was well taken. Many of the young engineers of this generation sooner or later find that their ambitions lie in executive or administrative work, although few of them, perhaps, realize it while in college. Granting that this is to some extent true, cannot the technical school, by starting them thinking along economic lines, be of greater help in the training of the executives which the coming period will need? It is the fortunate student, rather than the average young man, who can combine the broadening influence of a liberal-arts course with his technical training. Yet we are told by one of the leaders of the profession that: "The engineer is going to have from now on such obligations as he never had before; . . . he should saturate himself with sound economic doctrine." And certainly the biggest problems confronting mining executives today are not strictly technical. They are problems which the novitiate could observe and study effectively, if his attention were called to them and were he trained to study them systematically. To make the suggestion as constructive as possible, I venture to offer the following outline for a course of study, which might be called, for lack of a better name, "mining economics":

1. The Organization and Financing of Mining Companies. Methods of Organization. Stocks. Bonds. Comparison With Industrial or Railroad Companies. Over- and Under-Capitalization. Tendency Toward Large Corporations. Duties to Stock Owners. Reports.

2. Personnel Organization. Functions of Departments and Executive Officers. Importance and Value of Definite Distribution of Authority. Education and Training of Shift Bosses. Training of Men for Executive Positions. Efficiency Work—Its Value and Limitations.

3. Problems of Labor. The Increasing Recognition and Importance of "Welfare Work." Labor Unions. Grievance Committees. The Education of the Laboring Class, Especially Against Bolshevik Doctrines. Improvement of Living Conditions. Dangers of Paternalism. Insurance and Sickness Compensation. Bonus System. Profit-sharing.

Such a course would naturally be restricted to senior or post-graduate students. It would be necessary to avoid the natural tendency of the instructor to overreach his mark by attempting to go more deeply into the subject than the status of the class warranted. In avoiding that difficulty it would be as easy to sail onto the other rock, namely, the making of the course a mere dispensation of "dope," with the thinking all done for the student, in which case the value would most certainly be small. In beginning the study of each subject, the instructor might, in a lecture, outline the problem and point out the important points. Members of the class would then be given reading assignments to books of reference, technical journals, and papers, which already constitute a considerable source of information. To these the instructor might add as suggested by the outline, the examples cited being but a few of those equally apropos. The reports on these references would be given orally to the class, the function of the instructor being merely to stimulate and direct discussion. Of course, much would depend upon the personality of the instructor, as it does, indeed, in any course. It would be obviously impossible to go deeply into all the subjects mentioned, but if the student could be given an interest and studious attitude toward these problems, surely the time would be well spent.

Miami, Ariz., Feb. 2, 1919. A. P. ALLEN.

Rocky Mountain Club To Welcome Returning Fighters

The Rocky Mountain Club has been officially designated by Hon. Robert D. Carey, Governor of Wyoming, s official representative to welcome Pershing's boys from Wyoming when they arrive in New York, thousands of miles from home. The Legislature of Wyoming has made an appropriation of $10,000 for the purpose.

Governor Stewart of Montana officially designated the club to represent Montana in welcoming Montana boys, and the Rocky Mountain Club has been advised that a bill has been presented to the Legislature calling for an appropriation of $25,000 for this purpose. The Rocky Mountain Club is further advised that Senate Bill No. 48 (Rocky Mountain Club Bonus of $10,000 Entertainment of Arizona Troops in New York City) has passed its second reading and has been referred to the Committee on Appropriations.

The Rocky Mountain Club has cabled to General Pershing that it has been designated to welcome his boys from the states mentioned.

It is a matter of regret that too many of our returning fighters have been landed here, far from their home and friends, without even a welcoming cheer. They wander about this city looking for a friendly face—too often in vain. Let us no longer permit the iron of indifference to sear their souls and make them doubt if their sacrifices were understood. Give them a real Western welcome straight from the heart, as soon as they set foot upon their home soil—a welcome that will assure them they are appreciated, and that their sacrifices for the cause of humanity have not been in vain.

Every resident and former resident and those interested in the Rocky Mountain and Pacific Coast states with which the Rocky Mountain Club is identified, men and women, who may be in New York during the period of demobilization—all are asked to help in order that the welcome their boys receive will be from the hearts of their own people. H. WALL,

Secretary Rocky Mountain Club of New York.

New York, Feb. 11, 1919.

Co-operation Among Small Mines

The article in the *Journal* of Nov. 9 is a move in the right direction. It is a matter of surprise to me that writers in the *Journal* appear to neglect the small operator. Many small operators are to a certain degree pioneers, and are dependent upon the *Journal* for technical information. They must depend upon the technical papers to bring to their attention new milling and metallurgical appliances. This in my judgment has been neglected. MINER.

San Miguel, Colombia, S. A., Dec. 15, 1918.

Details of Milling and Smelting

In a number of phases of the dressing and treatment of ores, it is found necessary to maintain a constant level of pulp in certain machines. This is especially true in the case of flotation cells, where the regulation is preferably insured by the automatic adjustment of the underflow, or tailing pulp. In the article on "Pulp-Level Control" a few simple and effective methods of maintaining a constant head in flotation cells are described; and it will be found that the suggestions embody schemes that are equally applicable to many other phases of wet metallurgical work.

Operations in connection with the repair of the arms of a roasting furnace are desirably performed with ease and without unnecessary loss of time. The note herewith published—"Furnace Arm Carriage"—describes a special type of track and roller, by the use of which the arms may be removed expeditiously and with the minimum of handling. The detail is an improvement which has been adopted at the reduction works of one of our most prominent and progressive copper-mining companies.

One of the troubles usually encountered in the operation of the ordinary design of sliding chute gate arises from the circumstance that fine ore and grit are likely to collect in the channel in which the partition slides, thus making it extremely difficult to open or close the gate. The suggestion published herewith, and described in the short article entitled "Improved Design of Chute Gate," aims to obviate this condition by the provision of a chamber around the edges of each side of the slide, and arranged with discharge ports which permit the accumulated fines to escape.

Pulp-Level Control

BY CLAUDE T. RICE

Uniform conditions are necessary in order to obtain the best results by flotation. One of the most important points needing attention is the level of the water in the cell. On most of the Callow machines used in the Cœur d'Alene plants this is regulated by means of a float pan and a lever which opens and closes the discharge valve. A screw is generally used to vary the length of the rod carrying the taper plug which regulates the discharge of the tailings.

A more convenient method of regulating the length of the plug rod is used at the Gold Hunter plant. It consists of a notched plate *A* (Fig. 1), which slides between two guide plates *B* on the float arm *C*. The valve rod *F*, which carries a taper plug *G* (for regulating the discharge of tailings from the tank), is flattened and has two straps *D* riveted to it, which carry, near the top, the pin *E*, which in turn rests in a notch of the plate *A*. By depressing the float arm and moving the pin into another notch, the size of the discharge opening can be varied in accordance with the amount of feed the machine is treating. After this main adjustment is made, any variation in the water level is corrected by the up or down movement of the float pan.

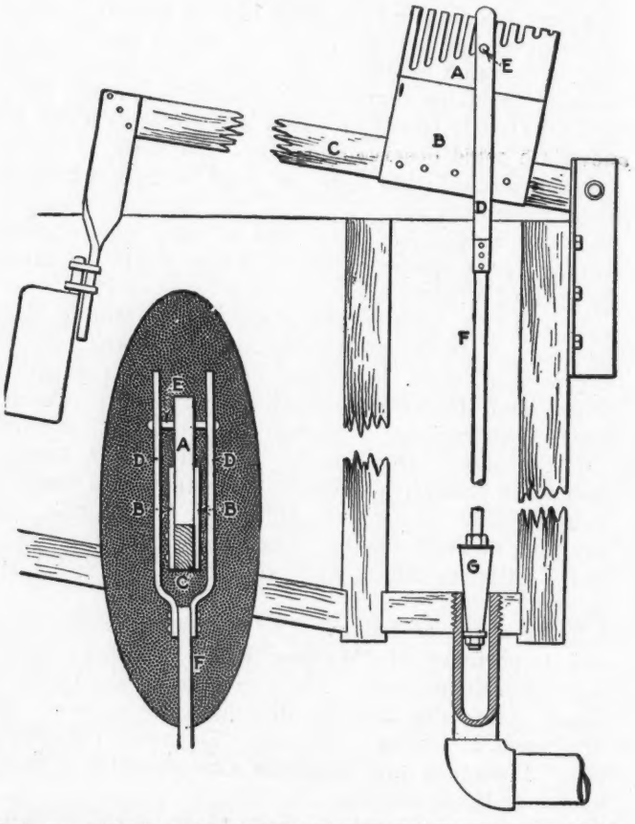


FIG. 1. REGULATOR USED AT THE GOLD HUNTER MILL

At many mills the float regulation of the water level is not favored, and more positive means are preferred. One such method consists of a gooseneck discharge devised by C. L. Hewitt and George Crerar. A pipe leads from the bottom of the cell tank (Fig. 2). A tee *A* is screwed onto this, so that the bulk of the tailings is discharged through opening *B* in a regulating plug that fits into the main discharge opening of the tee. A nipple *C* connects the tee to the gooseneck overflow pipe *D* through an elbow. The size of opening *B* is made such that though most of the tailings discharge through it, any excess rises in the gooseneck and discharges through that. By swinging the gooseneck on the nipple *C*, the water level in the flotation machine is controlled.

This gooseneck regulation of the water level is preferable to that obtained with the float and taper plugs, but it does not give a really positive regulation, and for that

reason is not so good as one which has been devised at the Bunker Hill & Sullivan plant by R. S. Handy. This consists of an air lift *A* (Fig. 3) in a water box *B*, that lifts the tailings into discharge box *C*, from which they

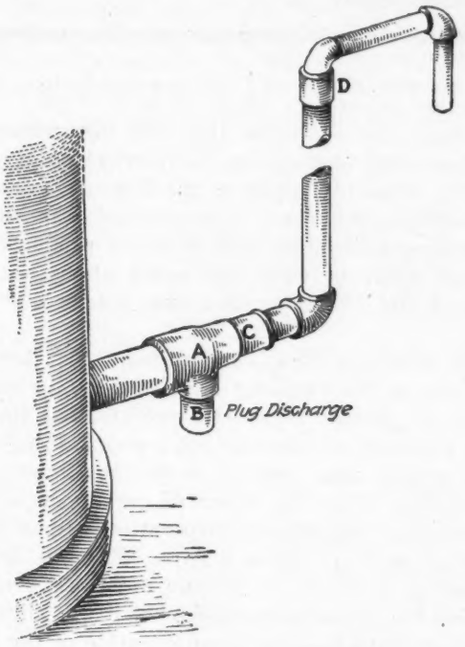


FIG. 2. GOOSENECK LEVEL REGULATOR

leave through pipe *E* in its bottom. The water rises in box *B* and overflows through the adjustable gate *D* into the discharge box *C*. Thus the level of the water in the flotation machine is maintained in a positive manner, as the elevation of the notch in gate *D* determines the water level throughout the whole machine. This discharge can be used on other types as well as on the Bunker Hill machine. It is the best method when air is available, as it generally is in flotation installations.

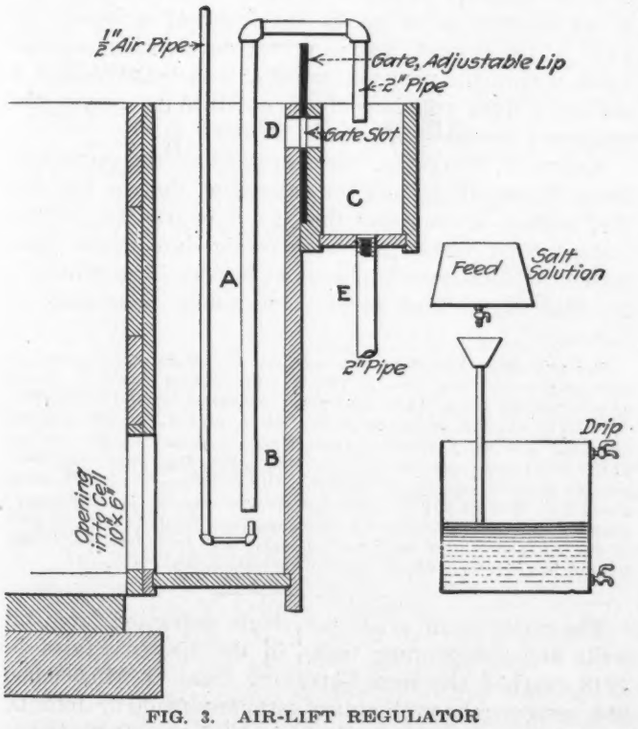
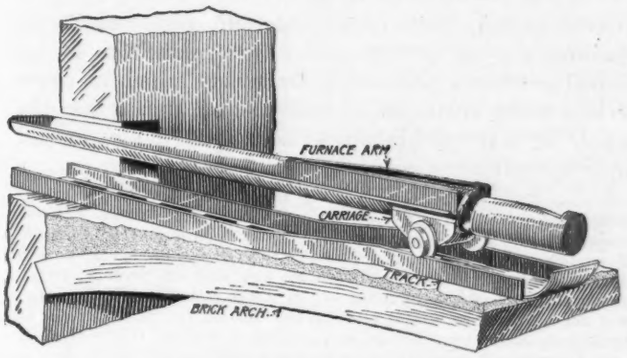


FIG. 3. AIR-LIFT REGULATOR

Furnace Arm Carriage

A special arrangement is used at the Anaconda Copper Mining Co.'s reduction works at Anaconda, Mont., in connection with the operation of removing the arms from the multiple-hearth roasting furnaces.



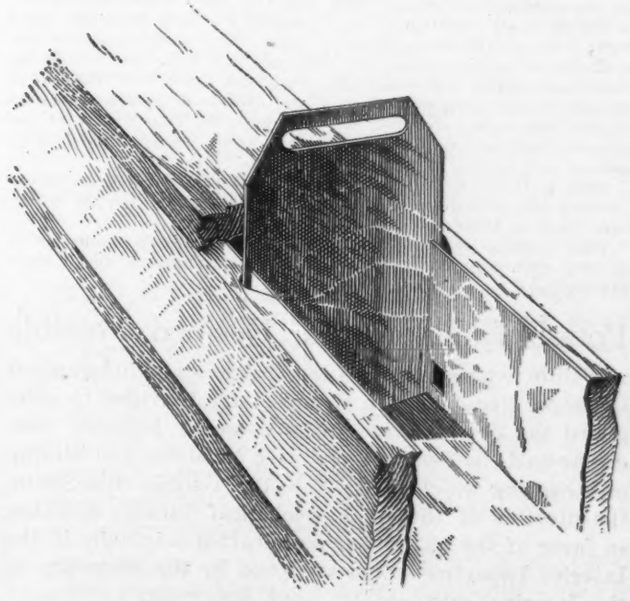
FURNACE ARM CARRIAGE

Details will be readily understood by reference to the accompanying cut, which shows the furnace arm resting on a specially designed carriage, which runs on the track, as shown. The track is placed temporarily under the arm to be removed, the arm lowered to the carriage standing to receive it, and both are drawn out onto a truck which stands outside.

Improved Design of Chute Gate

BY W. L. PROUTY

Loss through leakage often occurs in chutes carrying fine material; and it is sometimes impossible to close the gate tightly, or to open it after a shutdown.



CHUTE GATE OF NOVEL DESIGN

The adoption of the type of gate shown in the accompanying cut has resulted in an avoidance of trouble from such a source; and it has met requirements better than any other design in general use.

Industrial News from Washington

BY PAUL WOOTON, SPECIAL CORRESPONDENT

Agree on War-Minerals Relief

After prolonged discussion, the conferees on the Dent-Chamberlain bill providing for the legalization of informal contracts adopted a section intended to cover certain losses sustained in the endeavor to increase the supply of war minerals. Section 5, as finally agreed upon in conference, reads as follows:

Sec. 5. That the Secretary of the Interior be, and he is hereby, authorized to adjust, pay, or discharge any agreement, express or implied, upon a fair and equitable basis the amount or amounts of money heretofore invested or contracted to be invested and obligations incurred in good faith by any and all persons, firms, or corporations for producing or in good faith acquiring property for producing, within the United States, for the purpose of supplying the urgent needs of the nation during the war, any ores or mineral substances mentioned and enumerated in the act entitled "An act to provide further for the national security and defense by encouraging the production, conserving the supply, and controlling the distribution of those ores, metals, and minerals which have formerly been largely imported, or of which there is or may be an inadequate supply," approved Oct. 5, 1918, the production of which was requested or demanded by the War Industries Board, the War Trade Board, the Shipping Board, the Emergency Fleet Corporation or the Department of the Interior and which has been performed in whole or in part by any such person, firm, or corporation prior to Nov. 12, 1918; and that said Secretary ascertain, determine, adjust, liquidate, and, out of the moneys provided and appropriated by said act, pay to the parties justly entitled thereto the amounts of such losses and damages as he, the said Secretary, shall find and determine to have been sustained by reason of having made said investments for said purposes, and tnat in each case he shall make such determination, provision, settlement, advancement, or final payment, or by agreement with claimants take such other action as he shall find and determine to be just and equitable; that the decision and action of said Secretary in each case shall be conclusive and final; that all payments shall be made, and all expenses incurred by the said Secretary shall be paid from the funds appropriated by the said act of Oct. 5, 1918, and that said funds and appropriations shall continue to be available for said purposes until such time as the said Secretary shall have fully exercised the authority hereby granted and performed and completed the duties hereby provided and imposed: Provided, however, That said Secretary shall consider, approve, and dispose of only such claims as shall be made hereunder and filed with the Department of the Interior within three months from and after the approval of this act.

That a report of all operations under this section, including receipts and disbursements, shall be made to Congress on or before the first Monday in December of each year.

That nothing in this section shall be construed to confer jurisdiction upon any court to entertain a suit against the United States.

Potash Independence Deemed Possible

Within five years the United States can be independent in the matter of potash if means are provided to safeguard the development of the domestic industry, producers told the Senate Committee on Mines and Mining at a hearing which began Feb. 13. George Otis Smith, the director of the U. S. Geological Survey, speaking in favor of the bill, which was drafted originally in the Interior Department and approved by the Secretary of the Interior, said:

Under this bill, a market is provided for domestic potash. That market, to some degree, can be competitive among the various producers, but protected against foreign competition. An import license is to be issued conditioned upon purchase or agreement to purchase, say, 30% of domestic potash. The price is not a question—the lower the better. The consumer and the producer can work that out. The producer is protected by the assurance of the market through this bill. The consumer, in turn, is safeguarded by the proviso enforcing a fair price.

Dr. Smith also explained that the Government has been endeavoring to stimulate the production of potash since 1911, when the action of the German potash monopoly had brought about a commercial war. It was stated by representatives of all domestic producers that they would make no claim for relief under the War-Minerals Relief Act provided the potash bill were passed.

Senator Jones, of New Mexico, fears that the price will be fixed at the high-cost level if the bill should be passed in its present form. He prefers that the Government purchase at varying but reasonable prices all domestic potash and resell it to the consumer at the average price. This, he admitted, would require the formation of a Government corporation with a revolving fund of several million dollars. The bill, as originally drafted in the U. S. Bureau of Mines, contained a provision for such a corporation, but it was eliminated by Secretary Lane to make administration of the bill as simple as possible.

The producers attempted to establish that they would be able promptly to reduce costs and to improve their processes to the point where they will be able to compete with many other producers. If no such steps as have been suggested are taken, they will be forced, within a very few months, to compete with German stocks, some of which were piled up by the labor of prisoners of war. If the several lines of potash development are not killed within the next six months, it is believed that a sufficient start will have been obtained to insure the country a permanent potash industry.

Arthur C. Harragin, the secretary of the American Trona Corporation, told the committee that he realized that it must be convinced that it will be possible, within a short time, to compete with foreign producers. His statement with regard to costs at Searles Lake, which is the first of the kind to be made public, is in part as follows:

Our average production costs per ton of potassium chloride in 1918 at Searles Lake were as follows: Steam plant, $19.60; labor, $6.03; cost of brine, 52c.; and plant overhead, $3.85; total, $30.

To this amount must be added $3.75 and $3.50 for general overhead and sales expense, respectively, making a total cost of $37.25 to produce one ton of 100% KCl salts. Therefore, the total cost to produce one ton of potash salts of a grade of 80% KCl, about 50% K_2O, is $31.25. The freight and war tax is a "postage-stamp rate" of $17.72 per ton of salts from Trona, Calif., to any of the market centers in the southeast. The total cost to us delivered is, therefore, $48.97 per ton of salts of 80% KCl.

The quantity of crude petroleum marketed from oil wells and field-storage tanks in the United States in 1918 reached the record-breaking total of 345,500,000 bbl., as shown by preliminary estimates made by John D. Northrup, of the U. S. Geological Survey, Department of the Interior. This output is an apparent gain of 3% over the former high record, 335,315,601 bbl., established in 1917.

Monthly Copper Production for 1918

The table which appears herewith is compiled from reports received from the respective companies (except in the cases noted as estimated), together with the reports of the U. S. Department of Commerce as to imported material, and in the main represents the crude-copper content of blister copper, in pounds.

MONTHLY CRUDE-COPPER PRODUCTION, 1918

	September	October	November	December
Alaska shipments	4,216,816	4,142,744	6,607,216	16,407,461
Arizona:				
Arizona Copper	4,330,000	4,060,000	4,000,000	3,600,000
Cons. Ariz. Smelting	1,200,000	1,200,000	1,030,000	1,060,000
Inspiration	7,800,000	8,125,000	7,500,000	7,350,000
Magma	747,805	949,455	992,271	1,049,783
Miami	5,012,865	4,945,178	4,382,170	4,989,435
New Cornelia (a)	2,468,000	2,390,000	2,272,000	2,804,000
Old Dominion	2,292,000	2,373,000	2,101,000	2,686,000
Ray	7,250,000	7,490,000	7,020,000	5,800,000
Shannon	722,000	800,000	684,000	688,000
Shattuck Arizona	686,844	744,069	583,655	506,332
United Verde Extension	4,623,300	4,702,500	4,348,942	4,000,000
Other Arizona	25,002,934	26,604,700	24,567,938	22,765,668
California:				
Mammoth	1,140,000	910,000	1,140,000	1,660,000
Michigan:				
Calumet & Hecla	10,341,468	11,929,929	10,499,711	10,539,706
Other Lake Superior (b)	7,000,000	7,000,000	7,000,000	7,000,000
Montana:				
Anaconda	21,800,000	23,450,000	22,600,000	21,900,000
East Butte	2,134,700	1,823,000	2,100,000	1,929,720
Nevada:				
Mason Valley	1,682,340	1,086,200	1,073,400	1,273,176
Nevada Cons.	6,670,415	6,700,000	6,601,000	5,800,000
New Mexico:				
Chino	7,936,000	7,063,000	6,464,285	5,507,635
Utah:				
Utah Copper	17,785,000	19,000,000	16,500,000	13,835,000
Eastern smelters (b)	1,750,000	1,750,000	1,750,000	1,750,000
Total reported	144,592,487	149,238,775	141,817,588	144,901,916
Others, estimated	13,400,000	19,400,000	17,400,000	16,900,000
Total United States	157,992,487	168,638,775	159,217,588	161,801,916
Imports: Ore and concentrates, etc	10,828,810	10,112,365	15,399,815	10,196,022
Imports in blister, etc	37,570,650	33,884,114	27,793,791	26,405,704
Grand total	206,391,947	212,635,254	202,411,194	198,403,642
British Columbia:				
Canada Copper Corpn	142,466	191,433	.....	.....
Granby Cons	3,371,535	2,549,474	2,147,405	2,955,450
Mexico:				
Boleo	1,764,000	1,873,760	2,072,324	1,785,840
Cananea	4,900,000	4,300,000	5,100,000	5,100,000
Phelps Dodge, Mexican properties	4,308,845	3,791,602	3,551,418	2,023,000
Other Foreign:				
Cerro de Pasco	6,150,000	5,836,000	5,398,000	6,410,000
Chile	7,346,000	8,548,000	9,854,000	10,902,000
Katanga	4,887,598	3,306,900	551,250	2,513,244
Backus & Johnston	2,435,442	2,503,945	2,103,163	.....

(a) Only electrolytic cathodes are entered. New Cornelia also produces some copper from ores sent to Calumet & Arizona smeltery, which is included under "Other Arizona." (b) Estimated.

The production of the United States by months during 1918 is as follows:

	Pounds
January	165,431,568
February	160,011,364
March	185,525,168
April	163,207,096
May	181,070,350
June	166,723,599
July	159,329,031
August	165,550,799
September	157,992,487
October	168,638,775
November	159,217,588
December	161,801,916

The item "Alaska shipments" gives the official figure of the U. S. Department of Commerce, and includes Kennecott production from its Alaskan mines.

The grand total includes, under "Imports in ore and blister copper," the production of such companies as Canada Copper, Granby, Cananea, Braden, Cerro de Pasco, and Chile. As a matter of record, however, the individual figures are given after the total. We also report the production of the Boleo and Katanga companies, whose copper does not come to the United States.

By error, the figure for "Others, estimated," in October was given as 4,100,000 instead of 19,400,000. This changes the total for the United States to 168,638,775, and the grand total to 212,635,254.

Gold Committee's Report Made Public

WASHINGTON CORRESPONDENCE

No steps should be taken by the Government to stimulate or promote the production of gold. This is the judgment expressed by a committee appointed by the Secretary of the Treasury, on Nov. 2, to investigate the gold situation. The committee consists of Albert Strauss, Edwin F. Gay, Raymond T. Baker, Emmet D. Boyle and Pope Yeatman. The report was submitted to the Secretary of the Treasury on Feb. 11. After reviewing gold-mining conditions prior to the armistice and describing the change that took place when hostilities ceased, the committee draws these conclusions:

Under these circumstances, there is in our opinion no need for artificial stimulation of gold production. Not only has any need therefor passed, but there have come into operation causes that will in due time restore all industry, including the mining of gold, to a normal basis. Gold mining will then become again normally profitable and respond automatically to normal stimuli.

It is therefore the judgment of this committee that no steps should be taken by the Government to stimulate or promote the production of gold.

The representatives of the gold-mining interests very properly based their suggestions for relief on the public necessity for a larger production of gold and not on the hardships suffered by them as parties interested in an industry in which the margin of profit had been rapidly shrinking, and in many cases had entirely disappeared or been turned into a loss. They recognized that such diminishing profits and such losses were inevitable under the shifting conditions of war, and that merely as producers they had no better claim to relief than any other section of the community suffering a reduction of profits or incurring losses under the changing incidence of war conditions.

In the course of its consideration of the subject referred to it, this committee has conferred with a committee appointed by the American Gold Conference held at Reno in August, 1918, under the presidency of Governor Emmet D. Boyle of Nevada; it has had the benefit of the very complete survey of the conditions of the gold-mining industry contained in the report dated Oct. 30, 1918, of the committee appointed by the Secretary of the Interior to study the gold situation, of which Hennen Jennings, Esq., was chairman; and of the report dated Nov. 29, 1918, of the gold-production committee appointed by the commissioners of the British Treasury under the chairmanship of Lord Inchcape; and the committee has conferred with or secured the views of Prof. Irving Fisher and other eminent economists, besides which it has had referred to it a considerable volume of correspondence expressing widely varying views which had been received by the Secretary of the Treasury and the Director of the Mint.

It is interesting to note that the British Treasury committee arrived at the same conclusion as that which we have reached.

We cannot refrain from expressing gratification at the substantial unanimity of opinion among those whose position or experience entitles their views to respectful consideration against suggested measures of relief that would have had a tendency to undermine or upset our standards of value.

Foreign Notes

When the Germans, after the collapse of Russia, overran the country, one of their first objectives was the manganese mines in the Ukraine and the still larger deposits of that mineral in the Caucasus.

The new works of the Companhia Siderurgica Mineira at Sabara, Minas Geraes, Brazil, will be one of the most important iron works in South America. The company has a large stock of fuel with which to begin work as soon as the machinery is installed.

The surplus production of antimony is so considerable in France that this industry can hardly continue to exist on a paying basis unless producers come to an understanding among themselves.

Modern antimony works were established in Tonkin during the war by the firm of Schön & Rhay. Both native and Chinese ore is worked up.

Mining Regiment's Return Delayed

The 27th Engineers is still at Nantes. When the regiment entrained at Givry, early in January, it thought that it was well on its way home. It appeared, however, that transportation facilities were far short of the requirements to transport the men and that there were numerous organizations ahead of the 27th Engineers on the priority list. In the meanwhile, the time has been spent in the daily routine of drills and inspections, which are, if anything, more severe than before leaving the United States. After the excitement of life at the front, the men are heartily sick of the present stagnant existence. However, it seems likely they will surely be home in March. We understand that the regiment is destined to go to Camp Devens, at Ayer, Mass.

HOW THE COMFORT FUND STANDS

Receipts to Jan. 1, 1919, including interest	$19,745.21
Alaska Mining and Engineering Society	111.00
W. H. Corbould	6.50
Dover Laboratory	2.00
W. L. Strauss	10.00
Employees Braden Copper Co., Chile	34.00
W. C. J. Bartels	20.00
January interest	15.75
H. V. Maxwell	5.00
Leonard Loehr	5.00
Carl J. Trauerman (second contribution)	5.00
Total	$19,959.46

Checks should be made payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers. Owing to the work of administering the Comfort Fund, contributions are acknowledged only in the columns of the *Journal*.

Planning Sale of Government's Metals

The War Department's surplus stocks of copper, brass, and lead are to be marketed in a way that will have the least possible effect on the market. Before any plan is adopted for the sale of these stocks, producers will be consulted.

At a preliminary conference with representatives of the lead industry, it developed that the surplus quantity of lead in possession of the War Department is a very small proportion of a year's production. Though the figures are not yet final, on the basis of present information the department cannot have more than a few thousand tons to be disposed of ultimately. This quantity represents the surplus of lead in the possession of the War Department which was allocated by the lead producers' committee, at the instruction of the Ordnance Department, for use on cost-plus contracts. Although the details of the arrangement have not yet been worked out, it is practically agreed that some arrangement can be made between the War Department and the lead producers by which the surplus stocks of lead now in the hands of the department may be gradually fed into the market without affecting market prices and market conditions.

In regard to copper and brass, the representatives of the War Department, though anxious to prevent loss of the Government on this material, realize that it would be injurious to the industry, and especially to the workers, if the market prices were upset by throwing this surplus on the market over a short period. Such action would also tend to reduce market prices and thus defeat the desire to obtain for the Government a fair price for this surplus stock.

Idaho Mining and Geology Bureau

A bill has just been passed by the House of Representatives of the State of Idaho to provide for the creation of a State Bureau of Mines and Geology. Cooperative work with the U. S. Bureau of Mines and the U. S. Geological Survey is to be provided for, as well as geological and economic investigations of the mineral resources of the state.

Under the provisions of the law the Board of Control will comprise the Governor of the State of Idaho, who shall be ex-officio chairman; the dean of the School of Mines of the University of Idaho, who shall be ex-officio secretary of the board; the State Inspector of Mines; the head of the department of geology of the University of Idaho; and the president of the Idaho Mining Association.

Foreign Trade in Lead and Zinc

Imports and exports of lead and zinc, as reported by the Department of Commerce for December, 1918, are as follows:

IMPORTS

	December, Lb.
Lead	
Ore, metal contents	689,914
Imported from	
Canada	277,200
Mexico	153,185
British South Africa	259,529
Bullion, metal contents (from Mexico)	14,946,348
Pigs, bars and old	.....
Zinc:	
Ore, metal contents	2,938,281
Imported from	
Canada	932,866
Mexico	2,005,415
Blocks or pigs, and old	.....

EXPORTS

Lead (foreign exports):	
Pigs, bars and old	671,227
Lead (domestic exports):	
Pigs and bars, produced from domestic ore	4,441,279
Pigs and bars, produced from foreign ore	6,411,949
Spelter:	
Produced from domestic ore (pigs)	13,131,377
Produced from foreign ore (pigs)	3,272,856
In sheets, strips, etc	3,861,040

Foreign Trade in Copper

Exports of copper from the United States in December, 1918, are reported by the Department of Commerce as follows:

	December, Lb.
Ore	10,000
Concentrates	.....
Unrefined, etc., in bars	672,000
Refined in bars	44,698,993
Composition metal	32,580
Old and scrap	.....
Pipes and tubes	160,789
Plates and sheets	4,760,432
Wire, except insulated	1,336,193
All other manufactures	974,234

The weight of ore exported in December was 47 long tons. No exports of copper concentrates or of old and scrap are reported for the month.

Imports of copper into the United States in December, 1918, are reported by the Department of Commerce as follows:

	December Lb.
Ore	6,041,176
Concentrates	3,002,775
Matte and regulus	1,152,071
Unrefined, etc., in bars	26,405,704
Refined, in bars, plates, etc	2,687,560
Old, etc., for remanufacture	647,657
Composition metal	.....
Copper manufactures, all others	.....

Material imported in December was 19,189 long tons ore, 9338 long tons concentrates, and 1172 long tons matte and regulus.

The American Institute of Mining Engineers

The annual meeting of the Institute was held at New York beginning on Feb. 17 and was concluded on Feb. 20, with a visit to the Federal shipbuilding plant at Newark, N. J. Important subjects of timely interest were discussed, dealing to a considerable extent with problems of reconstruction now confronting the mining industry. Horace V. Winchell, of Minneapolis, Minn., was elected president for the coming year.

THE 119th meeting of the American Institute of Mining Engineers convened at the Engineering Societies Building, in New York, on Monday, Feb. 17. The registration amounted to 350 on the first day, comparing favorably with that of previous years. However, the fact that some members are still engaged in war activities, prevented them from being present.

A number of interesting papers were presented, including those dealing with technical subjects, as well as others on important problems of reconstruction involving labor difficulties, and employment of discharged soldiers and men crippled either by wounds received in the service or by industrial accidents.

The social entertainment, especially arranged for the ladies accompanying the delegates, began with a sightseeing automobile trip around New York, visits being made to the American Museum of Natural History, where a special mineralogical display was arranged; to the Spanish Museum, the American Geographical Society, the American Numismatic Society, and the Cathedral of St. John the Divine. On Tuesday, visits were made to the Metropolitan Museum of Art and the art galleries of the Hon. William A. Clark. In addition, the arrangement included several receptions, the annual banquet and an all-day excursion to the Federal shipbuilding plant at Newark, N. J. The entertainment of the visiting ladies was undertaken by the Woman's Auxiliary of the Institute, which arranged a complete program. The Auxiliary held several meetings dealing with organization matters.

Horace V. Winchell, of Minneapolis, Minn., was elected president of the Institute for the coming year. Other officers elected were Edwin Ludlow, Lansford, Penn., and A. R. Ledoux, New York, as vice-presidents. The directors elected were as follows: J. V. W. Reynders, New York; George D. Barron, Rye, N. Y.; Charles F. Rand, New York; Louis S. Cates, Ray, Ariz.; Stanly A. Easton, Kellogg, Idaho.

A memorial meeting was held for the members who lost their lives in service during the war and also for Dr. Rossiter W. Raymond, who died Dec. 31, 1918.

Among the papers read at the session on Industrial Organization, which was presided over by B. F. Tillson in the absence of H. I. Young, was the "Prevention of Illness Among Employees in Mines," by A. J. Lanza, which evoked a spirited discussion. The practice of dry drilling in hard rock was criticized by Mr. Lanza, and in the discussion which followed, C. W. Goodale stated that, in overhand stoping, miners preferred the present method to working with water, because of wet ground. The discussion also confirmed the fact that dust in coal mines apparently does not produce tuberculosis to a great extent. Limestone is also not considered very injurious. However, siliceous rock was accepted as the cause of a large amount of lung diseases among miners, which evil is to some extent lessened by improved ventilation.

J. P. Monroe, vice-chairman, Federal Board for Vocational Education, told of the attempt of Bolshevist leaders to introduce a revolutionary labor movement into this country, choosing Lawrence, Mass., as the most favorable spot for a beginning. The movement was unsuccessful, the American Federation of Labor, the United Mine Workers of America, and other workmen being decidedly against it.

The paper presented by Major Robert M. Yerkes on "Mental Tests in Industry" created considerable interest. The psychological tests applied by the U. S. Army for the selection of officer material were described and methods of rating various degrees of intelligence were given.

Another paper of interest was one by T. T. Read, on "Mental Factors in Industrial Organizations," which traced many of our present labor difficulties back to the mental causes which produced them. The discussion pointed out the benefit of welfare work and social activities of the workers in an industrial organization in providing an effective remedy in overcoming the present tendency for the workman to see in his work only the unpleasant necessity of earning a living.

The session on petroleum and gas was enlivened by a discussion on the paper of Dorsey Hager and G. W. McPherson, which was read by James F. Kemp in the absence of the authors. Under the title of "Cement Plugging for Exclusion of Bottom Water in the Augusta Field, Kansas," the effectiveness of the methods for preventing the flooding of wells was discussed. The discussion brought out the fact that in various fields no successful method has been discovered, and some operators were entirely skeptical of accomplishing such an object.

A new spirit characterized the proceedings at the "smoker." A year ago war and the preparation for more war dominated the minds of everyone. On Monday night, 300 members of the Institute lifted their voices in the National hymn with a joyousness that only the realization of the termination of the world war could bring. Together with their Canadian confrères they sang the Canadian anthem. E. P. Mathewson then introduced John T. Terry, the cartoonist. Terry quickly demonstrated that many prominent members of the American Institute of Mining Engineers were known to him. George C. Stone paraded before his astonished fellow members on an Australian kangaroo. H. C. Hoover's cartoon met with emphatic approval. H. V. Winchell's "back from Russia and never going there any more" caused many chuckles. Mark L. Requa was introduced as the only man who had ever driven the automobiles off Fifth Ave. on Sunday. J. E. Johnson, Jr., smiled on everyone, and cautioned the members not to blow out the light. Sidney J. Jennings sported

around "as the greatest Roman of them all" in toga and laurel wreath—and smile. E. P. Mathewson was the only member who required red chalk additions. George D. Barron was shown coming out of Mexico with the information "that cactus isn't all that grows in Mexico." Many other members proved before this part of the entertainment was over that they had met the cartoonist and their features and characteristics had been registered.

George C. Stone and B. F. Tillson saw the geological map of New Jersey as they never saw it before, and were rendered speechless by the interpretation which E. P. Mathewson gave it. Probably there is no other geological map in existence that is so liable to misinterpretation as the one issued by the Geological Survey of New Jersey. George C. Stone's activities also were not limited by his interest in the geological map, as E. P. Mathewson very proudly exhibited a cigar advertisement which left the worthy Stone with nothing to say as to his commercial affiliation outside of the New Jersey Zinc Co. J. Parke Channing was also brought before the bar of membership approval by his apparent connection with a prominent Parisian firm interested in the sale of a well-known hair restorer. The entertainment also included moving pictures, songs, and stories, which combined to make the affair a notable success.

Tuesday was Canadian Mining Institute day. The non-technical session opened with a point discussion by members of the two institutes on the principles of mine taxation. This was followed by papers on industrial democracy and education by C. V. Corless and S. J. Jennings. The former said that workers must be given a sense of personal responsibility if they are to be freed of the notion that they are being oppressed by those in authority. Unless the economic facts of production are thoroughly understood both by capital and labor, a state of mind will result which may develop into Bolshevism.

In the afternoon the sessions were continued, T. A. Rickard in an opening paper making a plea for the elimination of those minor prejudices that distinguish the English-speaking peoples, and a broader recognition of the fact that Great Britain and her colonies and possessions have much in common with the United States. He also urged the revisal of American history books, particularly those which show a lack of impartiality not in keeping with historical facts. Dr. A. R. Ledoux said that it was encouraging to note that the spirit of the congress carried with it a broader recognition of the principles of ethics and applied Christianity. He drew attention to the fact that the barriers were down between the United States and Canada except for a few lengths of barbed wire in the form of tariffs which it was hoped would soon be swept away. This freedom of intercourse, he said, had resulted in the increased development of both countries and an appreciation of the value of reciprocity. The Great Northern R.R. was constructed by Canadians. The Canadian Pacific Ry. was built by Americans. American capital and American energy had contributed to the development of Canadian industry. On the other hand, Canadians were well and honorably known in the United States, and, in mentioning Douglas and Mathewson, Dr. Leoux paid a tribute to the country's northern neighbors, in the course of which he maintained that America can learn much from Canada. Disinterested advice in Washington on mining matters from Canadians would be welcomed and would be valued on account of its impartiality. Mexico also offered a promising field for coöperation between the two nations. Dr. Ledoux finally recommended that the two institutes—the American Institute of Mining Engineers and the Canadian Mining Institute—should appoint a joint commission to study the situation. Canada's advice would be valuable, as that country is further away from the trouble than the United States. The result of the coördination of impressions and opinions would inevitably lead to influencing public opinion, and much good would follow.

In commenting on Dr. Ledoux's remarks, chairman Jennings said that he had decided to go to Mexico in the immediate future, and would hold conferences in Mexico City at which the various problems would be discussed.

The question of Canadian and particularly Ontario mining laws was ably presented by T. A. Gibson, the mining commissioner of the Province of Ontario, who drew attention to the satisfactory features of the practice of settling disputes by means of a commissioner of this sort rather than by incurring the delay and expense that seemed unavoidable if such matters are taken before a Supreme Court judge.

The question of uniformity in mining legislation in North America was discussed by H. V. Winchell, who prefaced his remarks by stating that any such plan must start with the standardization of the laws of individual countries, so that local regulations at least were uniform. In Canada the various provinces can make their own laws, but this is not true of the United States, although each state in the Union can limit the rights given to prospectors under the Federal mining law, which provides that claims shall be 600 ft. wide by 1500 ft. long. This has been deemed excessive in several states, with the result that legislation has been enacted and the lengths in some states have been reduced to 200 or 300 feet.

Mr. Winchell drew attention to the honest and fair treatment that was invariably meted out to prospectors in Canada. The mining laws were liberal as regards the citizens of other civilized countries. In the United States it was necessary to be a citizen or one who had declared his intention to become a citizen before rights would be granted. In Canada the opportunity to develop minerals was open to all, regardless as to whether they were British subjects or not. The only persons who were not allowed to acquire mineral rights were Germans and other alien enemies. The Mexican mining law as it was in pre-revolutionary days was based on sound principles and long practice, and was taken from the old Spanish code. In concluding, Mr. Winchell expressed his belief that a uniform mining law for North America was impracticable, on account of the differing conditions, in all particulars, in the countries concerned. There was an opening, in his opinion, for a closer appreciation of the advantages of international intercourse which would lead to development and greater prosperity.

Editorials

The Course of Prices

THE course of prices in all of the free markets is downward, and rapidly so. Among the metals antimony went first, then zinc, then lead, and, finally, copper, the last being quoted this week at 16c. The only metals that now remain very high (on paper) are tin, in which Government officials have perpetrated an outrageous economic crime in order to conceal the consequences of their great gamble; and iron and steel, the magnates of which industry refuse to recognize that attractive prices ever stimulate consumption. There is too much of the atmosphere of the erstwhile Gary dinners still hanging over the iron and steel industry.

So it is with other commodities. The prices of many foodstuffs have started downward, but the fixed price of wheat holds everything back. The Government must keep its agreement with the farmers, but that does not mean it should not liberate the market. Among retail dealers in all commodities there is the traditional policy of maintaining prices until they have disposed of their stocks of goods at cost. Secretary Redfield and his colleagues are gravely talking about arranging prices on the basis of cost of production. The present market situation is temporarily one in which cost of production has nothing to do with the case.

The whole commercial situation is like that of a river that has been dammed up. The dam has broken and the water has begun to run through one hole after another, but some sections still stand, impeding free flow. They are crumbling away, and will soon go also. Not even are the steel magnates able to maintain a structure strong enough to resist indefinitely the pressure of economic law. When the obstructions have all gone, and the river of commerce flows freely again, there will begin to be a revival in business. In the meanwhile there is disappointment that the great declines in zinc, lead, and copper have not yet stimulated any considerable demand. Nor will there be such demand until the whole commercial current is flowing more freely or until offers are made to sell at prices so low that speculators will be induced to buy in anticipation of the rise that will inevitably follow at some later time.

Another great obstacle to the readjustment is the attitude of labor. Workmen complain correctly that the cost of living is still high. That consideration, however, is not going to stay the course of events. There is some slack that can be taken up. Employers can forego the profits to which normally they are entitled, as they have generously done already, and workmen can philosophically sacrifice the margin that they have enjoyed, as, indeed, they have done. There will have to be contraction in the scale of living in many directions. But just as the steel magnates stand in the way of readjustment, in the commodity markets, so do the railway brotherhoods and other aristocrats in labor. Naturally they enhance the difficulties of many other classes of labor ranging down to the ditch diggers and drudges, who have the hardest time.

It is hinted that the President has become alive to there being something seriously wrong with the economic situation. Some of the recent negotiations in Paris have been concerned with opening the German market for commodities. That will be very helpful, for no doubt Germany will desire to buy copper, cotton, and other materials. However, a good deal more than that has got to be done to right the situation. One of the best things the President can do is to call the new Congress immediately into session and request it to give prompt attention to the correction of economic evils, including the matters of the price of wheat, the incidence of taxation, the case of the railways, and the elimination of all governmental interference with industry and such public services as the telegraphs and telephones.

The Railway Problem

THE *Railway Age* of Jan. 17, 1919, published a timely editorial on the solution of the railway problem which contained considerable food for thought, not only for public men and railway officials, but also for the public in general. The railway problem is not a problem of railway officials or of Congress. It is broader than that; it is a national problem, a problem of all the people—one in which all men are vitally interested and one which must be solved by public opinion guided by the facts in the case.

The editorial mentioned points out that the problem cannot be studied from the point of view of the management, the operatives, owners, shippers, or of any other class, but must be looked at almost exclusively from the standpoint of the public. There must be a harmonizing of every class interest for the greatest public benefit, and with the attainment of this condition it will be found that no class suffers at the expense of any other class, but each is obtaining its just due. For example, under-payment of operatives will tend to lower the type of men that may be employed, resulting in inefficiency which will cause the public inconvenience. Excessive payment to operatives means higher charges to the public. Under-compensation or over-compensation to owners will affect the public in the same manner.

Looking at the question from the public standpoint, one may ask: "What will be the conditions accompanying a satisfactory solution of the railway problem?" The answer can be given in one sentence—adequate transportation facilities and good service, with passenger and freight rates as low as may be consistent with these requirements.

Adequate transportation facilities and good service—that is what the public wants, that is what it demands, and that is what it can have if it is prepared to treat fairly all those classes which together furnish the serv-

ice, and which it cannot have if it is not prepared to pay a fair price for the service that is rendered. It is also within the power of the public to see that it does not pay an excessive price for what it gets.

"Reason and experience," the *Railway Age* points out, "demonstrate that the desired results can be attained only through private ownership and operation," and in substance it approves of the suggestions of the Association of Railway Executives presented to the Senate Committee on Interstate Commerce, but points out that these do not go far enough. It says: "They would not insure that the average net return which the railways would be allowed to earn in the future would be any less inadequate than the average which they were allowed to earn before Government control was adopted."

Those conditions which it is necessary to bring about in order that the railways, under private ownership and management, may attain the ends which are most desirable of attainment in public interest, may be briefly stated as follows:

Reasonable competition in service and intense emulation in operating efficiency.

Coöperation and coördination in the operation of railways in the same territory, which, while not interfering with emulation and reasonable competition, will prevent the wastes caused by excessive competition.

Prompt, impartial, and expert determination of questions regarding the wages and working conditions of railway employees. The same may be said respecting freight and passenger tariffs.

The establishment of railway credit on a firm foundation. In this connection the *Railway Age* advocates the absorption of the weaker roads by the stronger companies in the same territory, because no adequate provision is made for establishment of their credit in any of the suggestions that have been offered. The reduction in the number of minor railroads would help the situation.

When the management of a mining proposition is confronted with the problem of re-locating a lost oreshoot, it sensibly calls in a geologist of experience. If the trouble is at the furnace, it calls in a metallurgist. Wherever the trouble may be, a specialist is needed. This practice has long been recognized by every successful business.

We trust that Congress will realize that it is not composed of railway men, and, like the miner, call for the specialist to assist in the solution of this intricate problem. Also that the public, in its desire for low rates, does not overlook the main point—adequate service—and in striving for a condition that may mean low rates temporarily defeat its best interest in service. It is our duty to use our judgment, but we should weigh seriously the advice of the specialist in forming our conclusions.

Whatever the answer, it will probably not come immediately as any one act of Congress. So large a matter can reach a satisfactory solution only in the course of development, where the best is kept and the mistakes are cast aside. Even then there will be no final solution, for changing national conditions must continue to change the operations of this most important of public utilities. The spirit of give-and-take must not only be invoked in trying to find a solution today—it must always prevail.

Concerning the Mine Prospect

A GREAT deal has been said regarding the prospector, his failures and his triumphs; and he has always formed a romantic character of the history of the mining industry. The article "Examining and Developing the Mine Prospect," which appears in this issue, throws an interesting sidelight on the practical consideration to which all mine prospects must be subjected, and the paper should be of timely interest, in view of the fact that increasing demands for precious metals will require extended operations by mining companies now in the field and those which will enter that branch of industry.

We believe the opportunity for legitimate enterprise is as great today as it ever was, but investors in mine properties are no longer willing to buy "a pig in a poke," and the prospector who would dispose of his holdings must have conclusive evidence that he is offering a proved proposition to his client. The element of chance in the purchasing of prospects is still present, but it can be reduced to a great extent by means of careful and analytical study. Painstaking consideration of all factors which may have a possible bearing on the determination of the status of the property under examination is urged by Mr. Curran, and the fact is emphasized that an indifferent report made by an engineer is to be avoided as much as one which attempts to overestimate conditions by means of an elaborate camouflage of geological terms frequently bewildering and misleading to the layman.

The mining engineer backed by experience and with the proper knowledge should be able to offer an opinion as to what work should be done to determine the further possibilities of the prospect, and the performance of such work should properly fall under the direction of the engineer. Many investors are prone to overlook the difference between the prospect and the producing mine. The management of the latter offers opportunity for a definite organization, the personnel of which may embrace considerable variation, depending on the magnitude of the operation. A business man with little or no technical training may, by reason of his executive ability, make an excellent producing-mine manager, but development of the mine prospect requires a versatility usually found only in the engineer.

The article on the prospect is worthy the attention of the engineer and the prospective investor alike. The comprehensive point of view taken by Mr. Curran should accomplish much in removing the misunderstanding that exists in certain quarters regarding the foretelling of prospects. Their reputable promotion is not a matter of magic or legerdemain, but the result of a careful analytical study of all local factors and conditions.

Copper Production in 1918

OUR statistics of the production of crude copper show that the output of American mines in December was 161,801,916 lb., compared with 159,217,588 lb. in November and 168,638,775 lb. in October. These monthly figures, which are the compilation of returns from all producers, are about 5% too high, owing partly to non-

allowance for losses in smelting, partly to the inclusion of some foreign copper that cannot be segregated, and partly to other causes; but month by month they are strictly comparable.

The December figures show that the copper producers kept their promise to the War Industries Board to maintain production, foolish as may have been the request for such a policy and the acceding to it. During 1918 the production of the mines was remarkably uniform. It attained a maximum of 185,525,168 lb. in March and showed a minimum of 157,992,487 lb. in September, but during most of the year the monthly figures were between 160,000,000 and 165,000,000 pounds.

The total for January, 1919, will show a great decrease and that for February a greater one. About all the copper produced since October is going into stock of refined. Including the imports, the arrivals, domestic and foreign, have been about 200,000,000 lb. per month. With about 250,000,000 lb. of crude copper at the refineries to start with, 100,000,000 lb. of refined on Jan. 1, and 600,000,000 lb. for the November-December-January production, we get approximately the total that was talked about in the official statement of Feb. 1.

The Hand of Death

IN THE morning papers of Feb. 16 appeared the following dispatch from Washington under date of Feb. 15:

Approval of the proposal to establish a Government price-adjustment board to stabilize conditions during the post-war period was cabled by President Wilson today to Secretary Redfield.

The organization, to be known as the Government Price Conference Board, will be constituted immediately. As devised by Secretary Redfield and his commercial advisers, the plan calls for an investigation of the costs of production of basic commodities under conditions as they have changed since the war and the determination of prices which the Government will pay. Early adjustment of prices will be sought to avoid the period of stagnation and commercial depression, with consequent unemployment, that might intervene if the process is left to the ordinary operation of supply-and-demand laws.

Secretary Redfield indicated that the personnel of the board would include a large number of men who served on the War Industries Board prior to its dissolution.

The first product for which prices will be recommended, it is thought, will be steel. The board will work through a series of subcommittees in each industry, which will report findings for the approval of the general body.

The above leaves us in doubt as to just what kind of new economic crime is meditated. If the new price-fixing is to be the publication of prices that the Government will pay as a buyer, there is not much in it. The Government does not want to buy things. It wants to sell them. Perhaps, however, it is thinking of the needs of the railways and the shipbuilders.

If, however, there is contemplated any further interference with the law of supply and demand, we shudder, as with the chill of the graveyard.

C. W. Purington writes from Vladivostok that he wishes the Allies would pay a little more attention to Siberia. At present the freight congestion is such that it is hard to get even one car of goods to the interior, where the civil population is so badly in need of supplies. The American railway men, under Mr. Stevens, are there, and in Harbin, waiting to be allowed to take charge, but so far have not been asked to do so. This letter was dated Jan. 1, 1919.

If we were mere stockholders and bondholders of the railway companies, we might view with complacency the proposal of the Brotherhoods that the Government appropriate 18 or 20 billion dollars to buy the railways and turn them over to the labor unions to run. But, as taxpayers and travelers, we confess to much alarm over this lunatic proposal. Taxes are high enough now, and railway service is bad enough. What they would be if the railways were in the hands of totally inexperienced managers we shudder to think.

"There will be perfect equality in the world only when nobody knows how to read and write," a speaker at a meeting of a Russian soviet is reported to have said. This is the ideal of socialism. Only when the people of the world are reduced to that degree will there be any real equality; but at that time they will be wearing the skins of animals and making fires by rubbing stones together. There may be real equality among the natives of Borneo, but we doubt even that.

BY THE WAY

Miners from the province of Galicia, or Gallegos, as they are known, are efficient, as miners go, among Spanish labor, but they are notoriously set in their ways; so much so, in fact, that they are invariably the butt of practical jokers and are made the subjects of innumerable anecdotes in the vernacular. The Andaluz, or southern miners, are generally good workers whose motto is that "All work and no play makes Jack a dull boy." It is almost superfluous to state that whenever a trick is played, the rule is not *"cherchez la femme,"* but "which Andaluz did it?" Recently a *Journal* reader was admonishing an Andaluz, and endeavored to bring the lesson home by quoting a story of a Cornishman that had appeared in this column. When asked if he understood just what a Cornishman was, the Andaluz smiled blandly and replied in pretty good English, "Yes, all right. We had a lot of those fellows at the Rio Tinto mine. We called them the Gallegos of England."

The mineral cubanite, or *cubanita*, was named by the mineralogist Breithout in 1843. Some authorities state that the specimen of ore responsible for the christening came from "Barracanao," but the correct name for the locality is Bacuranao. The theoretical formula of the mineral is stated to be $CuS.Fe_2S_3$, the composition being about 23.3% copper and 41.3% iron. The crystallization is said to be isometric, the mineral also occurring in massive form. In different parts of Cuba enthusiastic islanders exhibit various specimens of *cubanita*, varying in color from light yellow to dark brown. The structure is almost invariably massive. The cleavage may be cubical, but some interested persons feel that the product is not divided on the square. For present-day mineralogical classification, a convenient field definition of cubanite is "any off-color bastard sulphide of iron and copper that does not come up to the chalcopyrite standard." If, on the contrary, the name cubanite is to be confined to the mineral with the definite formula as given above, cubanite is a very rare mineral.

Personals

Have You Contributed to the Association of the 27th Engineers?

J. R. Buchanan is now manager for the Homestead-Iron Dyke Mines Co. at Homestead, Oregon.

L. O. Kellogg has sailed from New York for Ecuador, to resume his position as superintendent for the South American Development Company.

O. A. Dunlap has been elected vice-president of the Hollinger Consolidated Gold Mines, Ltd., Ontario, Canada, succeeding the late John McMartin.

C. D. Kaeding, general manager of the Dome Mines, Ltd., Porcupine, Ontario, Canada, has gone to California, where he will remain about two months.

Col. R. W. Leonard, president of the Coniagas Mines, Ltd., of Cobalt, Ontario, Canada, has been elected president of the Engineering Institute of Canada.

James C. Farrant, London representative of the Hardinge Conical Mill Co., who had been a prisoner of war in Germany for four years, has returned to England.

A. E. Hodgkins, formerly general manager of the Cheever Iron Ore Co., Port Henry, N. Y., has been appointed to the newly created office of comptroller of Witherbee, Sherman & Co., at Port Henry.

R. L. Herrick, formerly assistant publicity manager of the Ingersoll-Rand Co., has resigned to accept a position as managing editor for "Raw Material," which is published by the Gage Publishing Co., New York.

Thomas H. Mathias, formerly assistant general superintendent of the Lackawanna Steel Co., has been appointed general superintendent of that company. **George A. Whitehead** is now assistant general superintendent.

E. P. Barry, formerly Governor of Massachusetts, **John E. Allen**, of Boston, and **Walter Harvey Weed**, of New York, were recently in Butte, Mont., inspecting the property of the Crystal Copper Co., situated near Basin, Mont.

Capt. Gerald L. Wendt, recently discharged from the Chemical Warfare Service, has resumed his duties as assistant professor of chemistry at the University of Chicago, and as a member of the editorial board of the bulletin of the Chicago Section of the American Chemical Society.

Errol MacBoyle, mining engineer, who recently concluded the consolidation of the Union Hill, Eureka-Idaho-Maryland mines, in Grass Valley district, Calif., and the formation of the Gold Point Mines, Inc., taken over by the Bulkeley Wells interests, has been retained as consulting engineer and a director in the company. His office is now at 1112 Hobart Bldg., San Francisco, California.

C. W. Purington writes from Vladivostok, Russia, that temporarily he has joined the staff of the War Trade Board there, under the direction of August Heid, attaché to the War Trade Board. Together with Reuben Smith, he will soon make a trip to the interior to try to ascertain the proper distributing channels for the goods which it is planned to send for the relief of the civil population.

Societies

International Mining Convention will be held in Vancouver, B. C., Canada, Mar. 17-19.

Engineers' Society of Western Pennsylvania, held its regular monthly meeting at the Union Arcade Bldg., Pittsburgh, Penn., Feb. 18. The subject for the evening was "The Camera in the War," by C. E. K. Mees.

American Institute of Electrical Engineers, Denver Section, held its regular monthly meeting on Feb. 15, at the Denver Athletic Club, Denver, Colo. The speaker of the evening was G. N. Robinson, of the General Electric Co. The subject of the address was "Electric Welding." Many interesting lantern slides were shown.

The Teknik Club of Denver, Colo., held its regular meeting and dinner at the Shirley Hotel, on Feb. 11. Following the dinner, Harry J. Wolf presented a paper on "The Manganese-Silver Problem," in which he reviewed the various efforts that have been made to solve the difficulty, and described recent developments in connection with the uses of reducing gases.

Colorado Scientific Society held its regular meeting on Feb. 15, at the Shirley Hotel, Denver, Colo. This was the first of a series of dinner meetings planned for the ensuing year. The speaker was S. A. Ionides, who addressed the meeting on "Sulphuric Acid" and presented some of the later developments in connection with the manufacture of certain chemicals and explosives. A discussion by various members of the society followed.

American Society of Civil Engineers held a meeting Feb. 19 at the Engineering Societies Bldg., 29 West 39th St., New York. Nathan C. Johnson spoke on "New Developments in Concrete." Motion pictures traced the concrete process from the earliest days, the actions of the respective materials were shown in their several phases; the processes of manufacture were minutely analyzed, and means for producing more uniform and reliable concrete was indicated. A thorough discussion of the subject followed.

Industrial News

Detroit Steel Products Co., Detroit, Mich., has reëlected John G. Rumney as president.

Choctaw Engineering Co., Poteau, Okla., has recently been organized. S. D. Callaway and J. E. Davis are the members of the company, and will engage in consulting, mining, and civil engineering.

National Conduit and Cable Co., New York, has elected Joseph C. Baldwin, Jr. as director to fill the vacancy caused by the death of Capt. J. R. de Lamar. W. S. Eckert has been elected vice-president of the company in charge of sales.

White & Brothers, Inc., smelters and refiners, Philadelphia, Penn., has opened an office at 919 Oliver Building, Boston, Mass., to take care of the large increase in the New England demand for electrolytic and casting copper, ingot and babbitt metals.

Material-Handling Machinery Manufacturers' Association has been formed, following the suggestion of the Department of Commerce and the United States Shipping Board. The suggestion was made by these two agencies because of the need for intensive study of the freight-handling methods at both railroad and ocean terminals, and the association will take up the whole field of material handling and so touch every industry. The active work will be done by the secretary and manager, Zenas W. Carter, formerly commissioner of the Associated Metal Lath Manufacturers. The officers of the association are: President, Calvin Tomkins; vice-president, J. A. Shepard; treasurer, Lucian C. Brown; directors, Mr. Shepard, Mr. Brown, R. W. Scott, F. W. Hall, William Clark, J. C. Walter, C. M. Watson, and Fred Stadelman. Four additional directors are to be chosen when the charter membership is completed.

Trade Catalogs

Dump-Bottom. W. L. Goodwin, 1515 North 40th St., Seattle, Wash. 3½ x 8½; illustrated. A pamphlet describing the Goodwin-Holman patent dump-bottom.

Buckets. Lakewood Engineering Co., Cleveland, Ohio. Bulletin No. 26, 8½ x 11, pp. 24, illustrated. The principal features of the design and construction of the Lakewood clam-shell buckets are described.

Gasolene Locomotives. Milwaukee Locomotive Manufacturing Co., Milwaukee, Wis. Publication No. 110; 10 x 7; pp. 32; illustrated. General description and specifications of the different types of Milwaukee gasolene locomotives.

Simplex Ore Separators. W. O. Arzinger Machinery Co., Nashville, Tenn., pp. 8; illustrated. Descriptive of the Simplex ore separators for the treatment of ores by the flotation process. Details regarding the equipment will be furnished on request.

Steam and Electrical Equipment. F. William Stocker, Inc., 1119-1121 Clinton St., Hoboken, N. J. Pamphlet, 8 pp. A list of new and second-hand equipment used in mining, including air compressors, air receivers, boilers, wire rope, crushers, hoisting engines, and pumps.

Boiler Logic. Heine Safety Boiler Co., St. Louis, Mo. Pp. 86; 6 x 9; illustrated. A treatise covering some fundamental considerations of boiler design; practical baffling of water-tube boilers; Heine boilers for different fuels, firing, and services; overloads; the boiler as a pressure vessel; and details of the construction of the boilers.

New Patents

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Alloys Rich in Phosphorus; also Metallic Phosphides, Process of Making. Paul E. Demmler, Pittsburgh, Penn., assignor to Westinghouse Electric and Manufacturing Co. (U. S. No. 1,287,653; Dec. 17, 1918.)

Blower, Rotary. Ira H. Spencer, West Hartford, Conn., assignor, by mesne assignments, to Spencer Turbine Co. (U. S. No. 1,288,728; Dec. 24, 1918.)

Cement, Acid-Resisting. Alfred Ewart Holley and Harry William Webb, Oldbury, England, assignors to Chance & Hunt, Ltd., Oldbury, England. (U. S. Nos. 1,287,995 and 1,288,413; Dec. 17, 1918.)

Coke, Manufacture of. Arthur McDougall Duckham, Ashstead, England. (U. S. No. 1,289,045; Dec. 24, 1918.)

Conical Mill. Harry W. Hardinge, New York, N. Y., assignor to Hardinge Conical Mill Co., New York, N. Y. (U. S. No. 1,288,573; Dec. 24, 1918.)

Copper From Its Ores by Leaching and Flotation, Process of Extracting. Harry W. Morse, Los Angeles, Calif., assignor to Chino Copper Co., Hurley, N. M. (U. S. No. 1,288,121; Dec. 17, 1918.)

Filtering, Process and Apparatus for Continuous Pressure. Jasper A. McCaskell, Salt Lake City, Utah. (U. S. No. 1,288,433; Dec. 17, 1918.)

Flotation—Concentration of Ores. Oba Wiser, Hurley, N. M., assignor to Chino Copper Co., Hurley, N. Mex. (U. S. No. 1,288,350; Dec. 17, 1918.)

Furnace, Annealing. William A. Wood, Dunellen, N. J., and Walter S. Rockwell, New York, N. Y., assignors to W. S. Rockwell Co., New York, N. Y. (U. S. No. 1,288,353; Dec. 17, 1918.)

Furnace, Electric. Leo L. Simpson, Seattle, Wash., assignor to Adrian H. Sroufe, Seattle, Wash. (U. S. No. 1,288,240; Dec. 17, 1918.)

Furnace, Electric. Lewis G. Rowand, Brooklyn, N. Y., assignor to New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,289,055-6; Dec. 24, 1918.)

Furnace, Electric. William K. Booth, Chicago, Ill., assignor to Booth-Hall Co., Chicago, Ill. (U. S. No. 1,287,849; Dec. 17, 1918.)

Furnace, Metal Heating. Walter S. Rockwell, New York, N. Y., assignor to W. S. Rockwell Co., New York, N. Y. (U. S. No. 1,288,202; Dec. 17, 1918.)

Gases, Process and Apparatus for Electric Arc Treatment of. Frans Henrik Aubert Wielgolaski, Christiania, Norway. (U. S. No. 1,287,807; Dec. 17, 1918.)

Refractory. Louis P. Kraus, Jr., New York, N. Y. (U. S. No. 1,289,049; Dec. 24, 1918.)

Rope and Cable Thimble. Edward O. Keator, Dayton, Ohio. (U. S. No. 1,288,021; Dec. 17, 1918.)

Rope Clamp. Reinhold Loos, Newark, N. J. (U. S. No. 1,288,943; Dec. 24, 1918.)

Slag Pocket. William M. Whalen, Erie, Penn. (U. S. No. 1,288,328; Dec. 17, 1918.)

Steel, Chrome. Child Harold Wills, Detroit, Mich. (U. S. No. 1,288,344; Dec. 17, 1918.)

Steel. Ingot Stripper. David Kendall, Alliance, Ohio, assignor to Alliance Machine Co., Alliance, Ohio. (U. S. No. 1,288,023; Dec. 17, 1918.)

Steel. Manufacture of Openhearth. Herbert C. Ryding and Anson W. Allen, Birmingham, Ala. (U. S. No. 1,289,057; Dec. 24, 1918.)

Steel (Spring). Containing C, Mn, Cr, Si and Mo. Child Harold Wills, Detroit, Mich. (U. S. No. 1,288,345; Dec. 17, 1918.)

Steel and Iron, Solution for Rust-Proofing. William H. Allen, Detroit, Mich., assignor to Parker Rust-Proof Co. of America, Detroit, Mich. (U. S. No. 1,287,605; Dec. 17, 1918.)

Sulphur Mining. Robert E. Carmichael, Damon, Tex., assignor of one-half to George Hamman, Houston, Tex. (U. S. No. 1,287,878-9; Dec. 17, 1918.)

Well-Drilling Machine. George R. Watson, Waterloo, Iowa. (U. S. No. 1,288,319; Dec. 17, 1918.)

Well-Drilling Machines, Ram Attachment for. Harry E. Brown, Augusta, Kan. (U. S. No. 1,287,865; Dec. 17, 1918.)

Editorial Correspondence

SAN FRANCISCO—Feb. 12

The Summary of Oil-Well Development and production in California in December, 1918, reported by the Standard Oil Co., embraces all fields and shows a total of 46 new rigs, 331 wells in process of being drilled, 41 completed, and seven abandoned. The total number of wells producing was 8606. The total average daily production in all fields for December was 275,596 bbl. or a total production for the month of 8,543,476 bbl. The crude-oil stocks on Dec. 31 amounted to 32,042,923 bbl., total shipments being 8,434,463 bbl. The summary for November, 1918, which is the last summary to be compiled and issued by the Pacific Coast Petroleum War Service Bureau, showed 34 new rigs, 348 wells in process of being drilled, 47 completed, and one abandoned. The total number of wells producing was 8473 in November, the daily initial production of completed wells totaling 6293 bbl. in that month. The total average daily production in November in all fields was 277,618 bbl., or a total production in the month of 8,328,540 bbl. Total crude stocks Nov. 30 were 32,265,746 bbl., total shipments not being recorded. The crude-oil prices at the well, posted by the Standard Oil Co. on Jan. 15, 1919, are the same as posted and effective May 1, 1918, without change during that period.

Supervision of Oil Wells in California in the last four years, under a state law, has been carried out in such a practical way and been so generally beneficial to operators and conservative of oil measures that it is rather surprising that it should be necessary now to amend the law. The amendment sought by the State Mining Bureau, a department of which exercises supervision over oil and gas, provides for the enforcement of a section requiring all operators to protect the petroleum and gas deposits. The authors of the original measure believed it was sufficient to provide for recourse to the courts by operators who might object to the demands of the oil and gas supervisor. But it appears this provision was not sufficient. There have been few, but notable, failures to obey the law strictly. So it is now necessary to provide by legislative amendment that, if on or before 10 days after the date of service of notice of any order of the supervisor which has become final and absolute, or in case of action in court to enjoin the enforcement of an order, the owner or operator has not in good faith begun the work, the supervisor may apply to the court to enforce such final order or decree and appoint agents necessary to enter the premises and perform the work. The amount expended by the supervisor for the performance of the work shall constitute a lien against the property. In any such foreclosure action, the court shall authorize a personal judgment against the person whose duty primarily it was to perform the work done by the supervisor, for any deficiency in the amount resultant from the foreclosure and necessary to meet the judgment. There are other amendments respecting the regulation of drilling, keeping of logs, and similar matters, all of which are essential if the law is to operate wholly to the benefit of the oil industry, and oil measures of the state are to be conserved. The law, as so far enforced under state supervision, has never worked a hardship upon owner or operator, and has resulted in such regulation that water infiltration has been greatly diminished and the life of the wells extended without damage to or infringement upon neighboring or adjoining wells. R. P. McLaughlin is the present oil and gas supervisor.

PHOENIX, ARIZ.—Feb. 13

A Strike at Jerome, begun early on Feb. 10, when the copper companies put into effect a cut of 75c. per day in men's wages, affected about 4000 men. The union miners, affiliated with the International Union of Mine, Mill and Smelter Workers, obeyed instructions from leaders to remain at work pending the arrival of Federal Mediator Hywell H. Davies, who, Secretary of Labor Wilson telegraphed, would start immediately. The United Verde and United Verde Extension companies issued a joint ultimatum to employees on Feb. 11, that both properties would shut down indefinitely unless enough men returned to work to keep smelteries supplied with ore. Miners at Jerome had voted to accept the new scale under protest, but were intimidated and kept away from the shafts. The new rate of pay is 75c. higher than under the old Miami sliding scale. The United Verde made the following announcement: "We wish to state, in all frankness, that we are discriminating against the I. W. W. and Bolshevik element, where we know that such men are in our employ." The labor troubles must be most inopportune from a labor viewpoint, for the condition of the copper market is causing general curtailment of output at the larger properties, and scores of shipping properties are closing down entirely. The Sasco smeltery of the American Smelting and Refining Co. has shut down. The Swansea lease is stopping operations at Swansea, in northern Yuma County, although it is completing a 250-ton mill. Great Western, at Courtland, has suspended, largely because of water, and the Johnson camp has about ceased to ship. The Bush and other shipping properties near Tucson are also closed. Several shafts at Bisbee have been abandoned for the time being, and the miners transferred elsewhere or discharged. Most of the many development properties at Jerome are waiting until costs become lower.

MORENCI, ARIZ.—Feb. 10

Reduction of Wages in the Clifton-Morenci-Metcalf district went into effect on Feb. 10, in accordance with the following excerpts from notices posted on Feb. 8: "The present wage rates will be adopted as standard with copper selling at 26c. per lb., and the differentials on the existing wage scale will apply with copper selling above or below 26c. per lb. and down to 18c. per lb., which will be taken as a minimum for the present, whether copper sells below 18c. or not. In making the above adjustment consideration has been given to the present high cost of living, and the bonus of $1 per day to underground and 75c. per day to surface employees will be continued for the present." This changes the rate of miners from $5.01 per day to $4.41; of muckers from $4.30 per day to $3.70; and of craftsmen from $6.35 per day to $5.63.

SALT LAKE CITY, UTAH—Feb. 13

The Matter of Mine Taxation is still in the air. A meeting between various committees of the Legislature, the Governor, the State Treasurer, and representatives of the legal staff of the state has been held, and it is reported that a bill is to be placed before the Legislature fixing the rate of mine taxation at three times the net proceeds, allowance to be made for all actual and necessary expenses of production, with the exception of all Federal taxes and legal expenditures, salaries of corporate officers, and of officers and employees not resident within the state. With the passage of the law in this form, it is stated the occupation tax law would be repealed; and it is expected that the protesting companies above mentioned would then pay the million dollar assessment, dropping their present suit.

Apex Rights are once more the cause of a suit between the Utah Consolidated and Utah Apex mining companies, Utah Consolidated in the present instance being the complainant, as was the Utah Apex company in the suit instituted last October, and later compromised. The same point as in the former case is at issue, namely the right of title to fissure veins apexing, according to the complaint, in the Keepapitchinin and Rattlesnake claims in Bingham. These veins dip to the north, passing through Utah Apex ground, and the complaint alleges that they have been entered at depth by the Utah Apex, that company, it is stated, having mined ore to the value of $500,000 from each vein. The Utah Consolidated asks that title to the veins in dispute be established, and that an accounting be made for the ore alleged to have been illegally extracted.

Reductions in Wages by Mining and Smelting Companies generally are being made. The reduction by Utah Copper Co. was noted in the last issue of the *Journal*. Other mines in Bingham have followed, and it is likely that reductions will be made by Park City and Tintic mines. The three smelting companies operating in the Salt Lake Valley have made reductions. The copper plant of the A. S. & R. at Garfield reduces employees receiving more than $3.90 per day by 75c. a day and those receiving $3.90 or less by 65c. The lead smeltery of this company at Murray, Utah, reduces employees receiving more than $3.80 a day by 65c. and those receiving $3.80 or less by 55c. The scale of wages at the Garfield plant varies from $7.10 per day to $3.65, and the scale in force at Murray is somewhat lower. The lead smeltery of the United States Company at Midvale makes reductions corresponding to those made at the Murray plant of the A. S. & R. The International, operating at Tooele, with a wage scale somewhat higher than the Garfield scale, makes reductions amounting to 75c. a day for employees receiving over $4.15 daily and a 65c. reduction for employees receiving $4.15 or less. The new scale of wages at the various plants became operative February 10.

Legal Proceedings Brought by Metal-Mining Companies against payment of occupation tax, fixed at 3% of net proceeds for 1918 (in addition to regular tax on physical valuation), have been dropped and nine companies have paid the amounts assessed against them plus 12% interest from the date when the tax became due. It is understood that, after this payment, the tax will be dropped and the matter of mine taxation in general cleared up. A law will probably be passed by the state Legislature fixing mine taxation at the rate of three times the value of the net proceeds (the amendment favorably voted on last fall called for taxation at some multiple of the net proceeds, setting no limit) and on surface values. It goes without saying that it will be of distinct benefit to the mining industry to be finally in the clear as to what is expected of it in the matter of taxation. Mining companies which have already paid the occupation tax above mentioned are the Utah Copper, Silver King Coalition, Grand Central, Eagle & Blue Bell, Bingham Mines, Cardiff, Victoria Gold Chain, and Ophir Hill, representing together, about $765,000. The Utah Copper paid $680,000. It is expected that the mining industry in general will make payment without protest. Funds from these sources will, it is stated, be used for the support of the schools of the state, particularly of the district schools. Coal-mining companies have thus far taken no action as to payment, and their assessment would, if paid, amount to about $100,000.

Analysis of the Copper Situation, as particularly affecting the Utah Copper Co., is made by R. C. Gemmell, general manager. Referring to the statement by the Federal Government on Feb. 4, 1919, Mr. Gemmell calls attention to the large surplus of copper stocks on hand, produced on the maximum basis of cost and with the expectation of realizing 26c. per lb., and to the present lack of market. Keeping these conditions in view, and with the absolute necessity of curtailment of output, the entire effort of the Utah Copper management is to maintain a going concern and keep the largest possible number of men employed. Although economy would be in the direction of the cessation of stripping operations, which are always kept several years ahead of production, these are being continued with a view to offering employment. Also, the Magna mill is operating at 50% capacity, when one mill would be able to care for the output. The closing of the Magna plant would mean either no work for the entire Magna force or half time at the Arthur for the consolidated forces. This will not be done unless absolutely necessary. An interesting point is that wages at the Utah Copper, in spite of the recent reduction, are higher than they were, after being raised four times in succession, on Dec. 1, 1916, the date of the fourth increase, based then on copper at 27½c. per lb. With the price of copper fixed at 26c. per lb., voluntary increases were made by the company three times subsequently in view of the high cost of living. In making the present necessary reductions in

wages, the company has again taken the cost of living into consideration.

Radical Changes in the Utah Workmen's Compensation Act are proposed. This has been operative in its present form since July, 1917, and is the first statute of its kind in the state. The danger to the mining industry from the changes proposed, before the law as now in force has had a try-out, are pointed out in a pamphlet prepared by the Utah Chapter of the American Mining Congress. A dangerous feature of the proposed amendment is the almost arbitrary power given to the commission in fixing the amounts of compensation, the commission's acts being subject to review only by the state supreme court and then in a very limited degree, and not by the district courts, which have jurisdiction under the law at present operative. The amendment also undertakes to eliminate private insurance companies, which assume responsibility in case of death, in favor of state insurance, which assumes no such responsibility. The scope of the law would be widened to include workers engaged in non-hazardous undertakings, though excluding domestic servants and farm laborers, the latter, it is pointed out, being at times certainly subject to danger. The amount of compensation would be materially raised. The present rate of compensation is 55% of the average weekly wage, not to exceed a maximum of $18 a week or a minimum of $7, and in no case to continue more than six years or to exceed $4500. It is now proposed to fix compensation at 66⅔%, with a maximum of $18 a week. There is also to be added compensation for especial injury, such as the loss of an arm at or near the shoulder, so that from the wording of the proposed amendment, which appears somewhat in doubt, and which it is pointed out a court might construe otherwise, a compensation equal to four-thirds of the actual weekly wage (or $36 for at least 200 weeks) would seem possible. The law will also be burdened with definitions as to dependents and children, the matter of minimum wage, hours for women and children and similar matters, which appear somewhat foreign to the question in hand.

BUTTE, MONT.—Feb. 17

The Philipsburg District is still producing a small quantity of manganese, and, according to one operator recently in Butte, a couple of mines will be operated up to about May 1, when contracts with steel companies expire. An effort will be made to develop some of the old silver properties.

The Butte Metal Mine Workers' Union called off its strike on the afternoon of Feb. 17 after a nine-days' struggle and the miners hastened to get their jobs back. More men presented themselves than could be taken care of. The strike was promoted by I. W. W. agitators in Butte, who were aided by reinforcements from Seattle and other points, causing much confusion in the city. It was conducted, according to the publications of the strikers, by the Soldiers', Sailors' and Workers' Council. The council, according to the secretary of the Metal Mine Workers' Union (independent), is composed of representatives from 15 labor unions, discharged soldiers and sailors, Industrial Workers of the World, the Pearse-Connolly Club (an Irish patriotic society), Socialists and others. Taking advantage of the reduction in wages to start trouble, the agitators soon enlisted in their ranks thousands of persons not in sympathy with I. W. W. teachings. Going several thousand strong to the roads leading to the various mines, they drove the miners back from work with sticks and guns until every mine in the district closed down, as well as the smeltery of the East Butte Mining Co. (shut down Feb. 10) and the Elm Orlu mill. Butte was early placed under martial law. Additional soldiers were brought into the city, but no sooner had they begun to deal with the strikers with a firm hand than the mayor of Butte stepped in and begged the commanding officer to call in his patrols, assuring him that the police would afford all necessary protection. The request naturally went unheeded. The I. W. W. element openly defied the authorities and distributed about the city circulars containing most seditious articles. It is commonly believed by citizens that profiteering by tradesmen is in large part responsible for the high prices prevailing in Butte, and this circumstance was made much of by the agitators to stir the people up. It was argued that the miners could not stand a wage reduction and support their families at the prevailing prices. With the mines down, plants dependent on them for ore followed; the Anaconda concentrator closed on Feb. 11, and the acid plant on Feb. 12. The backbone of the strike was said to be broken on Feb. 15 when the hoisting engineers of the mines voted by a majority of two to one not to join the walkout. The streetcars resumed operations in Butte on the same day. Thomas Campbell, president of the miners' union, said that the metal-mine workers had never declared a strike, despite the fact that some members, acting individually, joined with the I. W. W.

DENVER, COLO.—Feb. 12

Manganese Producers of Colorado hold that the Government should reimburse them for losses incurred in good faith in preparing for production, or at least give them time to extract ores blocked out and available for immediate shipment, before allowing imports of crude ore or ferromanganese. The Leadville district mines have available 150,000 to 200,000 tons of manganiferous ore running from 15% to 43% manganese, and low in silica and phosphorus; some also carrying up to 50% iron. Such ores have been shipped to Eastern markets, and used in making ferromanganese carrying 35 to 45% manganese. Much of this ore may be classed as blocked out, and under normal conditions could be shipped within about a year. The producers in the district have endeavored to increase production wherever possible, and through the sudden ending of the war have incurred a loss of about $200,000. Large bodies of ore have also been developed in the Gunnison district, and much money has been expended, but the operators have not had a chance to ship a carload. It is estimated that from 75,000 to 100,000 tons of ore suitable for ferromanganese has thus been made available there. One remedy suggested is that the Government announce that no licenses be issued for importing either manganese ore or ferromanganese during the first half of 1919. Such action would not enable the domestic producers to avoid all loss, but would help them to dispose of ore supplies now on hand at their properties, and might enable manufacturers to unload their supplies of finished product. Operators who go so far as to expect Congress to impose a protective tariff, think that it should amount to at least $10 a ton on crude ore and $25 a ton on ferromanganese.

DULUTH, MINN.—Feb. 13

Capt. Alexander McDougall's Patent for Washing Iron Ores is an adaptation from an old process and the principle involved therein invalid, it is claimed by attorneys of the U. S. Steel Corporation in the answer filed by them in the $40,000,000 suit brought by Captain McDougall against the corporation in the U. S. District Court in Duluth. The Oliver Iron Mining Co., the corporation's subsidiary affected, denies that McDougall's alleged invention is the first one for separating sand from iron ores on a commercially profitable basis. The Oliver company claims that the Greenway patent that it employs is based on apparatus successfully used for the purpose long before McDougall obtained his patent.

HOUGHTON, MICH.—Feb. 14

The Activities of the I. W. W. and other labor elements which are causing apprehension in the iron districts of northern Michigan will not affect the Lake Superior copper mines, it is believed by mine managers and labor authorities in the copper country, although the copper mines are operating, in general, on three-quarter time. The circulation of printed posters at Iron River, threatening the blowing up of public buildings and the homes of leading mining men and other prominent people, has resulted in that community appealing, through its legislative representative, for a guard of the state constabulary, and state authorities are making an investigation. Threatening posters of this sort have also been distributed at other iron country points, including Crystal Falls, since partial suspension of iron mining occurred at those places owing to the sudden termination of hostilities. Employees of the copper companies are apparently satisfied to accept temporary curtailment of output until a demand for the metal builds up. Pay has been lessened, also the number of working hours, and at some of the smaller mines total suspension of work has resulted. I. W. W. activities in the copper district soon after the United States entered the war were checked by the miners themselves, when thousands of men were out of work for eight months, the 1913 strike still being fresh in their memories.

JUALIN, ALASKA—Feb. 10

The Jualin Alaska Mines Co. will resume work at once on its property at Jualin, Alaska. This property was taken over by the Alguncian Development Co., a Belgian and French corporation with head office at 16 Rue de Turin, Brussels, Belgium. A 7800-ft. tunnel was started, intended to crosscut the vein system at a lower level and also to drain the mine water. This tunnel, which had advanced 2000 ft., was discontinued when the war broke out, and attention confined to actual production. All work was suspended in November, 1917, owing to labor shortage and extreme operating conditions. During the last operating year the mine produced nearly $200,000 in gold from a 10-stamp mill. It is now planned to complete the tunnel and at the same time to carry out an active program of development from the present workings. Until the completion of the tunnel, no ore will be milled except that coming from development work. Jean Vanophem, Brussels, Belgium, is president. Charles G. Titus, Juneau, Alaska, is general manager.

VICTORIA, B. C.—Feb. 15

The Committee Investigating Smelting Rates charged for treating custom ores at Trail has visited the management of the Consolidated Mining and Smelting Co. of Canada at the Trail smeltery, where a full discussion took place regarding the inquiry to be made and its scope. The committee is now engaged in making preparations for the securing of evidence from all who are interested. In this connection a circular has been issued and is being distributed among all shippers independent of the company. It reads as follows: "This committee has begun its work. Though it has extensively advertised its wish to receive either oral evidence as to facts or opinions of shippers of ore to Trail concerning their relations to the smeltery, it feels that further opportunity should be afforded for hearing from any who have thus far failed to make their position known to the committee. For this reason a copy of this letter is being sent to all shippers to ask their wider coöperation toward making our investigation completely successful and satisfactory to all concerned. Appreciating the fact that some shippers may naturally not desire to make statements in any public way, we wish to impress on you and them the fact that we are quite prepared to afford every reasonable opportunity for private hearing and discussion and that we will endeavor to make arrangements for this if necessary after hearing from you. We wish particularly to have it known that it is not only the matter of rates and charges as such that come within the purview of our work, but the collateral matter of sampling, settlement, or anything else which may, and often does, cause dissatisfaction. We shall be glad to receive any communication or complaints touching these matters, and trust that such will be sent to the secretary not later than Feb. 12 next."

Referring to Spanish Influenza and the difficulties which some mining operators have experienced because of it, an interesting account is given of the method adopted by a mining man with extensive interests around Sandon and Silverton, B. C. He has an understanding with his men that during the epidemic none of his men are to leave his employ, nor to come down from the mines for a "lay-off." On his part he undertakes to send no new men to work. The particular properties that he has in charge are thus rigidly quarantined, and he, himself, according to the arrangement, cannot go up to them, even on a trip of inspection. Consequently he is forced to direct operations by telephone. Though this is awkward, it is thought better than to take the chance of the influenza gaining a foothold in any of the camps in question, as, judging by other experiences, once established at such centers it does not leave until the lives of many are seriously jeopardized and the work completely disrupted.

The Vancouver Chamber of Mines has decided to change its title to that of the "British Columbia Chamber of Mines." This step has been agreed upon in order that the influence of the organization may be extended to include the whole province. At the last election of officers, a selection was made of some representative mining men outside of Vancouver, it being felt that, if the Chamber of Mines is to make its work beneficial to the industry of British Columbia, it must be understood to be a body belonging, not to any particular locality or community, but to the whole of the province and pledged to advance, wherever possible, the interest of all or any of its districts. Progress is being made in preparing for the International Mining Convention to be held in March, the effect of which, it is hoped, will be the creating of a complete understanding between the mining men of Western Canada and of the Western States and, generally, the engendering of a spirit of healthy optimism.

The Mining News

ALASKA

INFLUENZA reported at Copper Center; 42 cases on Jan. 19, with five deaths to that date.

SEWARD-ANCHORAGE BRANCH of Government railroad impassable between Mile 49 and Mile 71, owing to snow and ice. Freight and passengers carried across gap by dog and horse sleds.

ALASKA GOLD (Juneau)—In January milled 151,515 tons ore, averaging $0.787 per ton. Extraction 76.87%; tailings loss, 18.2c. per ton.

KENNECOTT (Kennecott) — January production of copper was 10,040,000 lb., including output of Braden Copper Co. December output, 14,114,000 pounds.

ARIZONA

Cochise County

DENN-ARIZONA (Bisbee)—Shaft sump being completed below 1800 level. Stations to be cut and exploration work begun on 1700 and 1800 levels.

SHATTUCK-ARIZONA (Bisbee)—January production was 622,226 lb. copper; 470,168 lb. lead; 32,204 oz. silver; and 101 oz. gold. Copper output in December was 506,332 pounds.

COMMONWEALTH DEVELOPMENT (Pearce)—Shipping 750 tons a month of siliceous ore to Douglas, for converter flux, Surface ores being mined by lessees. A. Y. Smith manager.

MIDDLEMARCH (Pearce)—Sinking for development and in hope of striking water supply for mill. E. L. Elson in charge.

Gila County

GILA COPPER SULPHIDE (Christmas)—Lease of American S. and R. Co. lapsed, and receiver again in direct charge. George Morris manager.

COLE-GOODWIN (Globe) — Formerly operated by Cole Development Co. and recently examined by Dr. G. M. Butler, dean of the College of Mines, at Tucson; being equipped for extensive development of large bodies of low-grade copper ores disclosed by investigation of Dr. Butler.

LONDON-ARIZONA (Chilito)—Reported preparing for operation, after settling financial difficulties; planning to ship ore eight miles to Hayden smeltery.

Greenlee County

ARIZONA COPPER (Clifton)—January production of copper was 4,032,000 lb.; December, 3,600,000 pounds.

Pima County

SULLIVAN (Ajo)—High-grade gold ore struck in claim near Gunsight. First claims, staked by J. J. Sullivan, now surrounded by 150 locations. Ore carries some silver.

SASCO (Silverbell)—Smeltery closed during week ended Feb. 15. Ore from Silverbell mines will be shipped to Hayden and El Paso plants of American S. and R. Company.

Santa Cruz County

HARDSHELL (Patagonia)—Grading for surface works and for sinking 350-ft. shaft.

HENRY FORD (Patagonia)—Name to be changed to "Victory" by owners.

IVANHOE (Patagonia)—Option taken by E. E. Bethel, of Washington Trading Company.

TRENCH (Patagonia)—Crosscut on 750 level nearing main ledge. Several stringers of ore found.

Yavapai County

PHILADELPHIA (Crown King)—Half of 100 ft. tunnel completed; to cut at 960-ft. depth orebody already explored 200 ft. by shaft. Property then will have 3600 ft. of tunnel development, mainly along main vein.

GADSDEN (Jerome)—Northwest crosscut on 1200 level 40 ft. into porphyritic schist speckled and seamed with native copper, chalcopyrite, and bornite. Crosscut headed to cut main fault, about 500 ft. further on.

JEROME-BISBEE (Jerome) — Formal transfer being made here of property of former Jerome-Portland company, under court order discharging receiver of old corporation.

JEROME-VERDE (Jerome)—High-grade shoot of copper glance cut in stoping about 100 ft. above 900 level of Maintop workings. Company has been shipping 600 tons a month of 8% ore to Humboldt. J. B. Harper, superintendent, will determine extent of new body, with expectation of shipping.

UNITED VERDE (Jerome)—Twelve-mile broad-gage line up hillside from portal of 1100-level tunnel will be finished early in summer; maximum grade 2¾%; rise 700 ft., and air-line distance three miles. New road will handle freight business of camp, including that coming from new steam-shovel work at crest of United Verde orebody. Shovel work will add northern extension to townsite on mine ground; two gulches to be filled in and leveled. Will run part of large slag dump below old smeltery site through Clarkdale furnaces.

UNITED VERDE EXTENSION (Jerome) —Tunnel near completion.

VERDE COMBINATION (Jerome) — Sump being finished below 1300 station. Drifts to be started both ways on contact, with occasional exploratory crosscuts.

PECK (Prescott)—This and other Bradshaw Mountain mines stopped by heavy snow; roads impassable.

Yuma County

ARIZONA DESERT M. AND M. (Bouse) —Planning to increase mill capacity from 20 to 60 tons daily by adding two ball-mill units. Ten men employed.

ARKANSAS

Independence County

BIG CAVE (Batesville)—Manganese production begun by Big Cave Manganese Co., operating near Penters Bluff. Property discovered in December, bottom of shallow shaft opening into natural cave which contained manganese veins in both walls, and nugget ore in clay in bottom. One car shipped.

POLK-SOUTHARD (Batesville)—Work begun with small force at manganese property by Independence Mining Co. Idle several weeks.

ROGERS (Cushman)—Manganese mining recently begun on Rogers tract by Stanley Hanford, operator, with two small crews.

ROUMINER-ROUGH (Cushman)—John Barksdale has small force mining manganese.

Marion County

BEARDEN (Rush)—Blytheville Mining Co., recent purchaser of Bearden land, has let contracts for drilling to prospect lower levels.

LONNIE BOY (Rush)—Zinc mine taken over by Stanley Hanford and associates, of Batesville. New owners will start operations at once.

MATTIE MAY (Rush)—New mill will be completed by April 1.

PAT BAKER (Rush)—Operated by Oklahoma Oil and Gas Co. Tunnel heading driven into old underground water course in which three runs of ore have been found. Two cars of hand-cobbed ore on dump ready for shipment. Strike made at 75-ft. depth.

SHEPHERD GROUP (Rush) — Zinc mines of J. C. Shepherd Mining Co., idle for last year, will start up soon. Largest producing group in north Arkansas field.

MONTEZUMA (Yellville)—Tract owned in fee and lease by Lucky Duke Mining Co. showing good ore. Prospect work to date entirely. Fifty discoveries of lead and zinc thus far. Tunnel now in 150 ft. displaying run of ore 40 ft. wide and 12 ft. thick.

NORTH STAR (Yellville)—New aërial tram tested and found satisfactory. Mill running and making good production of zinc carbonate.

CALIFORNIA

Amador County

MINES ON MOTHER LODE, including Kennedy, Argonaut, Central Eureka, Keystone, and Plymouth Consolidated, have increased working crews and are advancing development on largest scale since war began. Labor situation greatly improved.

Butte County

TRIUMPH (Lumpkin)—Ledge disclosed in new development in raise above old workings. M. B. Sears, manager.

DENVER (Forbestown)—H. R. Rountree reports surface buildings and other improvements will be ready for reopening mine early in spring.

Riverside County

TAHQUITZ (Riverside)—Newly incorporated by Charles DeLady, William Brandon and H. M. Anthony, of San Francisco.

San Bernardino County

GOLDEN WEST (Needles)—At annual election A. Rossiter made general manager; Charles P. Blanton, president, and Joseph Onetta, director. Property in Ibex district 26 miles northwest of Needles and west of Oatman, Arizona.

Shasta County

BOARDMAN ADDITION, comprising 720 acres, mostly within city limits of Redding, leased by Isaac Grant, of San Francisco, to J. B. Graves and L. Albach for mining purposes.

AFTERTHOUGHT (Ingot)—Death of John T. Milliken, of St. Louis, one of the owners, will not affect operation. John Tait Milliken, manager of Afterthought, no relation to deceased.

Tuolumne County

TUOLUMNE SUPERIOR (Sonora)—To operate National group of mines near Priest Station. Initial payment made on purchase. Will deepen 300-ft. shaft to 500 ft. and begin drifting.

COLORADO

San Miguel County

TOMBOY (Telluride)—Considering substitution of oil flotation for cyanide treatment. Details of equipment not fully decided upon.

IDAHO

Shoshone County

OLD HICKORY (Mullan)—You Like vein cut at 500-ft. depth. Will drift 800 ft. to east end line.

INTERSTATE CALLAHAN (Wallace)—January shipments were 3,418,000 lb. zinc; 1,215,000 lb. lead; and 20,320 oz. silver. Lead-silver output for month largest in company's history.

MICHIGAN

Copper District

CALUMET & HECLA (Calumet)—January production of copper by company and subsidiaries was 11,758,500 lb.; December, 11,399,036 lb. Ahmeek produced 1,928,305 lb.; Allouez, 486,708; Calumet & Hecla, 5,588,051; Centennial, 199,478; Isle Royale, 1,514,220; La Salle, 155,230; Osceola, 1,405,898; Superior, 76,610; and White Pine, 404,000 lb. Operations suspended in No. 2 shaft, Calumet; rails and other equipment removed. Shaft pillars removed from bottom and as near to surface as safety permits.

SENECA (Calumet)—Retiring directors reëlected.

ISLE ROYALE (Houghton)—January yield increased one-half pound refined copper per ton.

MICHIGAN (Rockland)—Shipping 100 to 150 tons rock daily to Baltic mill.

MISSOURI

Jefferson County

ST. JOSEPH LEAD (Herculaneum)—Smeltery at Herculaneum closed down. Concentrates being shipped to other smelteries. Result of excessive labor demands.

Joplin District

FREEHOLD OIL AND GAS (Waco)—Erection of new concentrator begun on No. 2 lease at Waco. Part of machinery used

taken from Smart & Crain mill at Lawton, Kan.; rest to be purchased new. Erection of third mill on another lease planned. Development on No. 2 property promising. Senator William Flynn, of Pittsburgh, Penn., owner o. Freehold properties; W. S. Marquiss, of Webb City, Mo., manager.

MONTANA

Silver Bow County

BOSTON & MONTANA (Butte)—George Gallup and Samuel Usher, of Boston, elected directors at annual meeting.

BUTTE MAIN RANGE (Butte)—Deepening of shaft begun from 800 level to 1200-ft. depth. Will cut station and crosscut at 1000 level. Shipped 150 tons ore daily until Washoe smeltery shut down. Operated by Tuolumne company.

BUTTE & SUPERIOR (Butte)—January production was 9,450,000 lb. zinc; December, 10,600,000 lb. Ore mined in January was 33,000 tons; December, 36,500. Mill recovery in January 94%. January silver output was 178,000 oz.; December, 225,000 ounces.

DAVIS DALY (Butte)—January production 1,018,889 lb. copper from 6022 tons ore, averaging 8.4% copper. Total development for last quarter of 1918 was 3135 ft., comprising 1277 ft. of drifts, 1696 ft. of crosscuts, and 162 ft. of raises. Shipments of ore during quarter totaled 15,191 tons, averaging 7.8% copper. Production during quarter was 2,432,010 lb. copper and 100,050 oz. silver.

POTOMAC COPPER (Butte)—Recently organized company expects to start operations around May 1. To complete three-mile wagon road and install compressor plant. W. P. Jahn, of Milwaukee, president.

NEVADA

Lincoln County

PIOCHE SHIPMENTS for week ended Feb. 6 were: Prince Consolidated, 29 cars ore; Virginia-Louise, 10; Consolidated Nevada-Utah, one.

Lyon County

NEVADA DOUGLAS (Ludwig)—Assessment levied of 10c. per share, payable by Feb. 20; delinquent sale, March 20.

Nye County

KANSAS CITY-NEVADA CONSOLIDATED (Bruner)—Has completed purchase of cyanide mill from Denver Engineering Works Co., which is erecting same; mill to be in operation in four months. Will pipe water for milling and domestic use 11 miles over Ione Valley; pipe bought from Pacific Tank and Pipe Co., San Francisco. About 1½ miles of underground work done on Phonolite Paymaster property, most of it in ore, since acquisition by company. Holdings include over 25 claims patented and paid for. Statement by R. E. Bruner, secretary.

TONOPAH SHIPMENTS for week ended Feb. 1 were 7389 tons, having gross milling value of $125,613. Shippers were: Tonopah Belmont, 2357 tons; Tonopah Mining 1100; Tonopah Extension, 1911; West End, 947; Jim Butler, 282; Montana, 232; Tonopah Divide, 175; MacNamara, 210; Midway, 54; Halifax, 43; North Star, 55; and miscellaneous, 23.

MAC NAMARA (Tonopah) — Reported planning to double mill capacity. Necessary construction work under way.

TONOPAH EXTENSION (Tonopah)—West drift on 1760 level recovered Merger vein recently; drifting on vein resumed. Mill operation interrupted by broken tube mill.

White Pine County

CONSOLIDATED COPPERMINES (Kimberly)—December production of copper was 1,637,997 lb., making total for 1918, 15,730,164 pounds.

OKLAHOMA

Joplin District

LA CLEDE (Picher)—Recently opened lead cave attracting attention. Large tonnage lead ore exposed in walls.

UTAH

Beaver County

HORN SILVER (Frisco)—Strike reported on 600 level. Company shipping crude ore and lessees working over old mill dumps.

Juab County

TINTIC SHIPMENTS week ended Feb. 7 totaled 148 cars.

CHIEF CONSOLIDATED (Eureka)—Additional pumping units ordered to help in handling flow below 1800 level.

GEMINI (Eureka)—Deep mining progressing in this and adjoining Ridge & Valley under same management. Pumps handling about 200 gal. per minute, making work possible at 1800 ft. Installation of equipment considered to permit work below this depth, where large tonnage is expected. Output curtailed somewhat owing to lead market.

MAMMOTH (Mammoth) — Company work suspended pending stabilization of copper market. Some lessees working and shipping.

TINTIC MILLING (Silver City)—Car of bullion shipped week ended Feb. 7.

Piute County

PITTSBURG-UTAH (Marysvale) — Last payment due on American Flag group potash claims stated to have been made, amounting to $5000. Purchase price $25,000. Company owns large acreage, in two groups.

Salt Lake County

AMERICAN S. AND R. CO. reduced wages 65 to 75c. per day on or about Feb. 11. Similar reduction made by International and by United States smelting companies.

ALTA SHIPMENTS during winter season held back by lack of snow, making sledding difficult. Situation improving.

MICHIGAN-UTAH (Alta)—Stockholders' meeting Feb. 10. Old board re-elected.

OLD EMMA (Alta) — Receiver's reorganization plan approved; includes consolidation of Old Emma, Emma Consolidated, and Emma Copper. Capital to be ample.

SELLS (Alta)—Maintaining production.

SOUTH HECLA (Alta)—During 1918 mined and marketed on company account 13,823,722 lb. crude ore, dry weight, at net stoping profit of $69,848. Lessees produced 4,641,982 lb. crude ore, dry weight, yielding company net profit of $3855. Combined metal content of ore produced was: 163,232 oz. gold; 112,920 oz. silver; 230,985 lb. lead; 577,773 lb. copper; 137,556 lb. zinc, and 4,261,888 lb. iron.

MONTANA-BINGHAM (Bingham-Canyon)—Closed down to await settling of metal market, according to official statement.

SILVER SHIELD (Bingham Canyon)—Car of ore ready for shipment.

Summit County

PARK CITY SHIPMENTS in January totaled 10,636 tons Shippers were: Judge Mining and Smelting, 2880 tons; Ontario Silver, 2779; Silver King Coalition, 2220; Daly West, 1012; Daly Mining, 700; Naildriver, 360; Silver King Consolidated, 185, and miscellaneous, 500 tons.

GLEN-ALLEN (Park City) — Building mill. Expects to begin production in spring or early summer.

SILVER KING COALITION (Park City)—Upper workings to be worked on leasing system advantageous to stockholders. S. A. Knowles, superintendent, to succeed James Humes. W. W. Armstrong, of National Copper Bank, president.

SILVER KING CONSOLIDATED (Park City)—Third car concentrates shipped from new mill, which is still in experimental stage. Spiro tunnel advanced 250 ft. in January; to develop Thaynes Canyon section and connect with California-Comstock workings.

Tooele County

WESTERN UTAH COPPER (Gold Hill)—Mill at Salt Springs to treat tungsten-copper ore from Yellowhammer group. In January treated about 400 tons ore carrying 3% tungsten and about 4% copper. Enough of this ore developed to warrant enlargement of mill, to be moved to more convenient site. Gold Hill mine shipped about 3000 tons during January.

WEST MERCUR (Mercur)—Suit filed against company to collect principal and interest on money loaned in last three years, amounting to $30,603. Company resumed work 1916. Camp in general inactive for several years.

Utah County

PACIFIC (American Fork)—Received during year just ended $10,842 in royalties on 50 cars shipped by Fissures Exploration from silver-lead property. Mill operated by Fissures Exploration.

WASHINGTON

Ferry County

NOB HILL (Republic)—Following officers elected at recent meeting: John Byrne, Spokane, president; Chester Shoudy, vice-president; O. A. Broyles, secretary-treasurer; John Byrne, Chester Shoudy, Thomas A. White, H. C. Kreysler, A. V. Chamberlain, Mrs. John Byrne, and J. E. Daley, directors.

Stevens County

UNITED COPPER (Chewelah)—To increase mill capacity. Work begun on winze from 1300 to 1400 level. Mill running three shifts.

LOON LAKE BLUE BIRD (Loon Lake)—Large flow of water struck in 70-ft. crosscut on 300 level; thought to indicate proximity of vein.

LOON LAKE COPPER (Loon Lake)—W. L. Zeigler supervising construction of new mill. Union Iron Works, Spokane, supplying equipment, including crusher, rolls, two 4 x 4 Union Iron Works ball mills, and flotation machines. Completion expected within four months. Will install new 50 hp. Ottumwa steam hoist.

CANADA

British Columbia

CONSOLIDATED M. AND S. (Fort Steele)—Work completed on main tunnel at Sullivan mine; over two miles long and will accommodate two standard tracks. Cost approximates $4,000,000. Sullivan group at present employs about 400 men; expected number will be increased soon to 1000. Preparation under way for new building to treat increased output of ore.

ROSEBERRY SURPRISE (Sandon) — Mill closed. Roseberry mill will handle ore hereafter.

RAMBLER CARIBOO (Slocan)—Milling hindered by snowslide, which stopped water supply.

GRANBY CONSOLIDATED (Vancouver)—January production of copper was 3,156,486 lb.; December, 2,955,450 lb. Anyox plant contributed 2,520,106 lb.; Grand Forks plant 636,380 pounds.

Ontario

JANUARY SHIPMENTS of silver ore over Temiskaming & Northern Ontario Ry. were: Beaver, 43 tons of 2000 lb.; Buffalo, 198; Dominion Reduction, 42; Hudson Bay, 33; La Rose, 127; McKinley-Darragh, 216; O'Brien, 37; Trethewey, 32; Miller Lake O'Brien, 26; and Casey Cobalt, 78; total, 832 tons. Above was shipped to following companies: Deloro S. and R., 303; Campbell & Deyell, 17; Cobalt Reduction, 43; and American S. and R., 469 tons; total, 832 tons. Alexo shipped 335 tons nickel ore.

MILLER INDEPENDENCE (Boston Creek)—Planning installation of mill and roasting plant of 100-ton daily capacity. Large tonnage of high-grade ore is being opened up.

ADANAC (Cobalt) — Annual, report states company has two separate bodies of high-grade ore from 3 to 12 in. wide. Recently 60 tons of 48-oz. ore shipped to mill.

CROWN RESERVE (Cobalt)—Another vein cut at 200 level.

NIPISSING (Cobalt)—Shaft No. 128 on east side of lake completed and exploration work started in adjacent territory.

RELIANCE (Cobalt)—Shaft down to 100 level and ore being taken out. John Shaw, lessee.

DOME EXTENSION (Porcupine)—Special meeting of shareholders called for Mar. 10 to ratify agreement giving Dome Mines working option until Mar. 15, 1920.

DOME LAKE (Porcupine) — Treated about 12,000 tons ore during 1918, millheads running about $9.65 per ton. Costs reported $8.27 per ton.

SOVEREIGN (Porcupine) — Extensive program of diamond drilling will be carried out.

ALEXO (Porquois Junction)—During first week in February four carloads nickel ore, or approximately 400,000 lb., shipped to smeltery at Coniston.

MEXICO

Sonora

GREENE CANANEA (La Cananea)—January production was 3,000,000 lb. copper; 106,480 oz. silver; and 780 oz. gold. Copper output in December, 5,100,000 pounds.

PERU

Junin

CERRO DE PASCO (La Fundicion)—January production of copper was 5,836,000 lb.; December, 6,410,000 pounds.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—January clean-up yielded $102,000.

The Market Report

SILVER AND STERLING EXCHANGE

Feb.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Feb.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
13	4.7575	101⅛	47⅞	17	4.7575	101⅛	47⅞
14	4.7580	101⅛	47⅞	18	4.7575	101⅛	47⅞
15	4.7580	101⅛	47⅞	19	4.7575	101⅛	47⅞

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Feb.	Copper Electrolytic	Tin Spot.†	Lead N. Y.	Lead St. L.	Zinc St. L.
13	17	66¼	4.95 @5.00	4.60 @4.65	6.20 @6.25
14	16¾	66¼	5	4.60 @4.65	6.25 @6.30
15	16¾	66¼	5	4.65 @4.70	6.30 @6.30
17	16¾	66¼	5	4.65 @4.70	6.30 @6.35
18	16¾ @16¾	66¼	5	4.65 @4.72½	6.30 @6.30
19	16 @16¾	66¼	5	4.70 @4.75	6.25

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. Special shapes command a premium and cathodes sell at a discount.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb. above St. Louis.

†For American tin of 99% grade.

LONDON

Feb.	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot
13	79⅛	72⅛	100	224⅛	223	29	25	48
14	78	74	100	225	223½	29	25	48
15	...	...	...	...	...	...	...	...
17	75½	72½	90	212	210	28½	25	45
18	74½	69½	90	203½	200	28½	25	45
19	74	69	(a)	206½	203½	28	25	45

(a) No quotations.

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

NEW YORK—Feb. 19, 1919

The chief feature of this week was the exhibition of real pressure to sell copper, and as a consequence thereof a further sharp decline in the price. The markets for lead and zinc were stagnant and substantially unchanged.

Copper—Small sales were made from day to day at steadily declining prices, although the market held up pretty well until today, in spite of sharp competition in which the big producers participated freely along with the small ones. This morning one producer succeeded in selling a round lot at 16⅜c., after which it was offered ineffectively at 16⅛c. and then at 16c., the offerings at the latter figure being made by more than one seller.

London cut the price for electrolytic copper to £90 on Feb. 17.

Copper Sheets—The base price of copper sheets is 24⅛c. per lb. Copper wire is quoted at 19½@20c. per lb. f.o.b. mill, carload lots.

Tin—The War Trade Board has decided to refuse licenses for the importation of tin ore by American smelters. This is one more step in the rake's progress, wherein it is classic that one bad step leads to another. However, the smelters are supplied with stocks of ore that will enable them to maintain production for several months to come. We understand that of the 10,000 tons of tin held by the U. S. Steel Products Co., from 5000 to 6000 tons has now been allocated.

Lead—The major part of the domestic consumption is now being filled on average-price contracts, wherefore open sales are relatively light. A fair volume of business was done this week, and during the latter part the market seemed to have a little firmer tone. The present rate of domestic production is probably about 30,000 tons per month, and domestic consumption is probably at or near the same rate. The disposition of the Mexican production, which is now estimated at about 6000 tons per month, is a problem.

Zinc—The market was very dull. After a slight rally, large offers by producers were met, causing a slight recession. Galvanizers bought a little spelter. Curtailment of production has now been begun, much belated.

High grade zinc has been sold at 7¼ cents.

The liquidation of the spelter stocks in France has been put in the hands of the Vielle Montagne company.

Zinc Sheets—Unchanged at $13 per 100 pounds.

Other Metals

Aluminum—31@32c. per lb. Unchanged.

Antimony—Dull at 7@7¼c. for spot.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.20 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.40 per lb. in lots of 500 pounds.

Nickel—Market quotation: Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound.

Quicksilver—Weak at $90. San Francisco reports, by telegraph, $90; weak.

Silver and Platinum

Silver—Silver bullion market continues quiet, with no change in the New York official price. The London fixed price has declined from 48 7/16d. to 47⅞d., owing to a reduction in transatlantic freight rates, so as to be on a parity with the New York price. No shipments of bar silver were reported last week for London; only 69,000 oz. foreign coin.

Mexican dollars at New York: Feb. 13, 77½; Feb. 14, 77½; Feb. 15, 77½; Feb. 17, 77½; Feb. 18, 77½; Feb. 19, 77½.

The general stock of money in the United States on Feb. 1, 1919, totaled $7,611,628,810; of this, $3,085,459,209 was in gold coin and bullion, $373,685,930 in standard silver dollars, and $242,203,752 in subsidiary silver. The money in circulation on Feb. 1 was $5,726,261,029, or $53.58 per capita. On Feb. 1, 1918, the per-capita circulation was $47.23.

Platinum—Refined ingot, $100.

Palladium—Quoted at $115.

Zinc and Lead Ore Markets

Joplin, Mo., Feb. 15—Blende, per ton, high, $48.10; basis 60% zinc, premium, $45; Class B, $42.50; Prime Western, $42@41; sludge, $40@38; calamine, 40% zinc, $25@27. Average selling prices: Blende, $41; calamine, $30; all zinc ores, $40.66.

Lead, high, $60; basis 80% lead, $56@50; average selling price, all grades of lead, $55.60 per ton.

Shipments the week: Blende, 10,153; calamine, 347; lead, 1325 tons. Value, all ores the week, $500,570.

Sellers are holding firm for higher zinc prices, several buyers failing to fill orders for amount needed this week, after advancing the price $1 to $2 per ton. Very bad weather prevails here, the district experiencing thoroughly wintry snows and blizzards. Some mines have ceased operations awaiting a higher zinc market. Shipments are in excess of production.

Platteville, Wis., Feb. 15—Blende, basis 60% zinc, $45 base for premium grade and $40 base for high-lead blende.

Lead ore, basis 80% lead, $50@55 per ton.

Shipments reported for the week are 2038 tons blende, 35 tons galena, and 73 tons sulphur ore. For the year to date the totals are 11,406 tons blende, 498 tons galena, and 73 tons sulphur ore. During the week 2392 ton blende was shipped to separating plants.

Other Ores

Chrome Ore—No inquiry.

Molybdenum Ore—Small business reported at 80@85c.

Tungsten Ore—No buyers.

Other Minerals

Pyrites—Unchanged. Ocean freights are obtainable at 22s. 6d. per ton.

Iron Trade Review

NEW YORK—Feb. 19

Business has been maintained at the rate of recent weeks. It is almost wholly, says "The Iron Age," for necessities, though the response to the public agitation for municipal improvement work has assumed some proportions. The situation is better than a month ago in that there will be 30 days less to wait for revived buying.

By the end of the week the machinery of the Government price-investigating board, which is to start with the steel trade, will be under motion. Doubts are expressed that proclamations naming what are officially regarded as fair prices will be convincing. The Government sitting in as a buyer is for the moment actually a would-be seller of all the war material and supplies no longer needed, and the investment project will wait for a paring of war wage rates as well as of war commodity prices.

Some time will likely be consumed in arriving at the new proposed stabilizing prices, and meanwhile the business world may have passed far enough along the road of convalescence from war shock to get active on its own account without Government intervention. What the trade regards as of far more importance is settlement of the railroad question and the many unpaid war contracts.

Export inquiry is in good volume, but high ocean freight charges are still a deterrent. For China 3000 tons of low-phosphorus copper-bearing pig iron has been sold. England lost a tin-plate order to the United States, which named $18.55, c.i.f. Lisbon. This, seeing that the Pittsburgh price is $7.35 per box, shows how much the buyer has to pay beyond the mill price. Seaboard prices for export are now about domestic prices.

A central selling organization has been established for French makers of rolled-steel products. It is a sign that the amount of American finished material exported to that country will be easily measured. American entry into European trade is marked in another way. A group of the steel trade is reported negotiating for the Differdingen mines and works, in Luxemburg.

The rehabilitation of the French collieries will cost, it is now estimated, $400,000,000, but part of it will necessarily be spread over ten years.

PITTSBURGH—Feb. 18

Rumors in circulation for the last two or three weeks that some steel producers are considering reducing prices in the immediate future are evidently without foundation, as nothing has transpired in that direction. Ever since the reductions of last December there has been a theory in the trade that the question of prices would, if possible, be made a matter of quarterly adjustment, in accordance with the habit followed by the War Industries Board during the period of Government control, and there was therefore expectation that, if any further reductions in steel prices were in order, the mills would be disposed to time them for April 1. Lately this view has been strengthened, for mills make no secret of the fact that, in some lines at least, further reductions are imperative if there is to be any hope of buying being stimulated, and the common view is that if there are further reductions they should be more substantial than those of last December, so that mills would feel free to make a stand upon them and insist to their customers that no additional reductions could be looked for.

Most of the Steel Corporation subsidiaries are operating at good rates. The American Sheet and Tin Plate Co. is operating at 99% of capacity in tin plate and at 80% in sheets, and is not stocking any material to speak of; the National Tube Co. is operating nearly at capacity and is building up stocks, which within two or three weeks will again be of normal proportions. The Illinois Steel Co. has a good run on rails, against old orders, but the Carnegie Steel Co. has practically no rail business. Plate mills generally are operating 50 to 60% of capacity, though bar and structural mills are hardly doing as well. The independents are not running as well as the Steel Corporation, and the industry as a whole is doing about 70% of capacity, against 85% in January, as shown by the monthly report of ignot production.

From nearly all quarters demand for steel products is very light, and present mill operations are predicated chiefly upon old orders, which will not last much longer. An exception to the general rule is the automobile industry, which is calling for fully normal tonnages of steel, and the demand for oil-country goods is practically normal. Several large orders for line pipe are definitely offered if relatively small price concessions are made, and in time the business will probably be put through. The matter is significant in that it is the first important case of regular investment buyers making a declaration as to the prices for steel at which they would be willing to act. In the matter of hotel and office buildings, bridges, and the like there are no such offers by investors.

Pig Iron—Two pig-iron meetings were held today at the William Penn Hotel, Pittsburgh, one in the morning of the Associated Manufacturers of Merchant Pig Iron and one in the afternoon of the American Pig Iron Association. No action of consequence was taken. Trade conditions were discussed. Greatly increased labor efficiency was reported, and it was learned that without any confusion, three merchant furnaces in the Valleys had discontinued paying overtime for hours worked in excess of eight. It was stated that it was practically impossible to sell pig iron in any tonnage. Prices are firmly maintained at former levels: Bessemer, $32.20; basic, $30; No. 2 foundry, $31; malleable, $31.50; forge, $30, f.o.b. Valley furnaces, freight to Pittsburgh being $1.40.

Steel—There is practically no demand for ordinary soft steel in unfinished form. Quotations are reported as being firmly maintained all along the line, but there is a theory that a keen buyer with a round tonnage to place might be able to secure a concession. Regular prices remain: Billets, $43.59; sheet bars and small billets, $47; slabs, $46; rods, $57. Shell steel and discard steel continue a drug on the market, and are available at prices nearer to scrap figures than figures quoted on regular soft steel.

Ferromanganese—Not much resale ferromanganese is heard of in the market, probably because holders know they could not dispose of it. Furnaces report their asking price at $200, delivered, for 70%, but there is no interest in the figure. Imported 80% could possibly be obtained at less than $175. We quote the market nominal at $175 to $200. Spiegeleisen is quotable nominally at $57@$60, furnace, for 16%.

Coke—Less demurrage coke is pressing the market, and to that extent the market is not as weak, but it possesses no real strength. Odd lots of furnace coke can be picked up at $4.50@$4.75, depending on quality, but for a regular supply operators would hardly quote below $5. Standard brands of foundry coke are held at $6, and a few sales are being made. Prices are per net ton at ovens, Connellsville region.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1917	1918	1919	1917	1918	1919
Jan.	75.630	88.702	101.125	36.682	44.356	48.438
Feb.	77.585	85.716	.....	37.742	42.792	.....
Mar.	73.861	88.082	.....	36.410	43.620	.....
April	73.875	95.346	.....	36.963	47.215	.....
May	74.745	99.505	.....	37.940	48.980	.....
June	76.971	99.500	.....	39.065	48.875	.....
July	79.010	99.625	.....	40.110	48.813	.....
Aug.	85.407	100.292	.....	43.418	49.077	.....
Sept.	100.740	101.125	.....	50.920	49.500	.....
Oct.	87.332	101.125	.....	44.324	49.500	.....
Nov.	85.891	101.125	.....	43.584	48.969	.....
Dec.	85.960	101.125	.....	43.052	48.492	.....
Year	81.417	96.772	.....	40.851	47.516	.....

New York quotations cents per ounce troy, 999 fine; London, pence per ounce, sterling silver, 925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan.	23.500	(a)	110.000	92.238	125.000	106.619
Feb.	23.500	.....	110.000	.....	125.000	.....
Mar.	23.500	.....	110.000	.....	125.000	.....
April	23.500	.....	110.000	.....	125.000	.....
May	23.500	.....	110.000	.....	125.000	.....
June	23.500	.....	110.000	.....	125.000	.....
July	25.904	.....	119.913	.....	134.913	.....
Aug.	26.000	.....	122.000	.....	137.000	.....
Sept.	26.000	.....	122.000	.....	137.000	.....
Oct.	26.000	.....	122.000	.....	137.000	.....
Nov.	26.000	.....	122.000	.....	137.000	.....
Dec.	(a)	.....	118.447	.....	133.167	.....
Year	24.628	.....	115.530	.....	130.507	.....

(a) No Market.

Tin	New York		London	
	1918	1919	1918	1919
January	85.500	67.702	293.227	248.557
February	92.000	.....	311.525	.....
March	(a)	.....	318.875	.....
April	(a)	.....	329.905	.....
May	(a)	.....	364.217	.....
June	(a)	.....	331.925	.....
July	(a)	.....	360.347	.....
August	(a)	.....	380.900	.....
September	(a)	.....	343.905	.....
October	(a)	.....	335.543	.....
November	(a)	.....	323.550	.....
December	(a)	.....	267.736	.....
Av. year	(a)	.....	330.138	.....

(a) No average computed.

Lead	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973	.....	6.899	.....	29.00	.....
March	7.201	.....	7.091	.....	29.00	.....
April	6.772	.....	6.701	.....	29.00	.....
May	6.818	.....	6.704	.....	29.00	.....
June	7.611	.....	7.511	.....	29.00	.....
July	8.033	.....	7.750	.....	29.00	.....
August	8.050	.....	7.750	.....	29.00	.....
September	8.050	.....	7.750	.....	29.00	.....
October	8.050	.....	7.750	.....	29.00	.....
November	8.050	.....	7.750	.....	31.20	.....
December	6.564	.....	6.324	.....	40.00	.....
Year	7.413	.....	7.222	.....	30.10	.....

Spelter	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7.836	7.272	7.661	6.922	54.000	56.045
February	7.814	.....	7.639	.....	54.000	.....
March	7.461	.....	7.286	.....	54.000	.....
April	6.890	.....	6.715	.....	54.000	.....
May	7.314	.....	7.114	.....	54.000	.....
June	8.021	.....	7.791	.....	54.000	.....
July	8.688	.....	8.338	.....	54.000	.....
August	8.985	.....	8.635	.....	54.000	.....
September	9.442	.....	9.092	.....	54.000	.....
October	8.801	.....	8.451	.....	54.000	.....
November	8.491	.....	8.141	.....	54.100	.....
December	8.163	.....	7.813	.....	56.050	.....
Year	8.159	.....	7.890	.....	54.180	.....

New York and St. Louis quotations, cents per pound London, pounds sterling per long ton.

Pig Iron Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37.25	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25	.....	33.95	.....	33.95	.....
March	37.25	.....	33.95	.....	33.95	.....
April	36.15	.....	32.95	.....	33.95	.....
May	36.20	.....	33.00	.....	34.00	.....
June	36.36	.....	33.16	.....	34.16	.....
July	36.60	.....	33.40	.....	34.40	.....
August	36.60	.....	33.40	.....	34.40	.....
September	36.60	.....	33.40	.....	34.40	.....
October	36.60	.....	34.40	.....	35.40	.....
November	36.60	.....	34.40	.....	35.40	.....
December	36.60	.....	34.40	.....	35.40	.....
Year	$36.67	.....	$33.70	.....	$34.45	.....

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. EXCH.†	Feb. 18
Alaska Gold M.	4
Alaska Juneau	2
Am.Sm.&Ref.,com.	65¼
Am.Sm. & Ref., pf.	103¼
Am.Sm.Sec., pf., A	92½
Am. Zinc	11¼
Am. Zinc, pf.	41
Anaconda	58¾
Batopilas Min	1
Bethlehem Steel	61¼
Butte & Superior	17¼
Butte Cop. & Zinc	5
Cerro de Pasco	32¼
Chile Cop.	18
Chino	33½
Colo. Fuel & Iron	36
Crucible Steel	57¼
Crucible Steel, pf.	92
Dome Mines	13
Federal M. & S.	9
Federal M. & S., pf.	36
Great Nor., ore ctf.	38¼
Greene Cananea	41¼
Gulf States Steel	53¼
Homestake	98
Inspiration Con.	43¼
International Nickel	27
Kennecott	29¾
Lackawanna Steel	66
Mexican Petrol.	175
Miami Copper	21¼
Nat'l Lead, com.	67
National Lead, pf.	108
Nev. Consol.	16¾
Ontario Min.	7
Ray Con.	20¼
Republic I.&S.,com.	74¾
Republic I.&S., pf.	102
Sloss-Sheffield	50
Tennessee C. & C.	12¾
U. S. Steel, com.	91¼
U. S. Steel, pf.	114¼
Utah Copper	67½
Va. Iron C. & C.	55

BOSTON CURB*	Feb. 18
Alaska Mines Corp.	‡.12
Boston Ely	.95
Boston & Mont.	.43
Butte & Lon'n Dev.	.12
Calaveras	1¼
Chief Con.	3¼
Contact	‡.05
Corbin	‡.25
Cortez	.13
Crown Reserve	.53
Crystal Cop.	.20
Eagle & Blue Bell	2¼
First Nat. Cop.	‡1¼
Houghton Copper	.30
Intermountain	‡.05
Iron Blossom	.47
Iron Cap	13¼
Majestic	.20
Mexican Metals	.28
Mines of America	‡.06
Mojave Tungsten	.04
Nat. Zinc & Lead	.08
Nevada-Douglas	.12
New Baltic	‡.75
Oneco	.20
Pacific Mines	‡.35
Rex Cons.	.06
Yukon Gold	.75

SAN FRAN.*	Feb. 4
Alta	.02
Andes	.03
Best & Belcher	.02
Caledonia	.03
Challenge Con.	‡.03
Confidence	.04
Con. Virginia	‡.05
Gould & Curry	.02
Hale & Norcross	.11
Jacket-Cr. Pt.	.03
Mexican	.08
Occidental	.40
Ophir	.09
Overman	.01
Savage	.07
Sierra Nevada	.03
Union Con.	.08
Utah Con.	‡.01
Belmont	3.50
Jim Butler	.39
MacNamara	.25
Midway	.27
Mont.-Tonopah	.15
North Star	.08
Rescue Eula	.09
West End Con.	1.20
Atlanta	.04
Booth	.13
Comb. Frac.	‡.02
Florence	.12
Jumbo Extension	.12
Kewaunas	.04
Nevada Hills	.03
Nevada Packard	.25
Round Mountain	.32
Silver Pick	.04
White Caps	.16

COLO. SPRINGS*	Feb. 4
Cresson Con.	4.87½
Doctor Jack Pot	.04
Elkton Con.	.04
El Paso	.14
Gold Sovereign	‡.02
Golden Cycle	1.74
Granite	.11
Isabella	.05¼
Mary McKinney	.07
Portland	1.00
United Gold M.	.14¾
Vindicator	.44

BOSTON EXCH.†	Feb. 18
Adventure	‡.60
Ahmeek	‡70
Algomah	.30
Alloues	‡43
Ariz. Com.	‡11
Arnold	‡.20
Bingham Mines	8¼
Bonanza	‡.10
Butte-Balaklava	.22
Calumet & Ariz.	60
Calumet & Hecla	426
Centennial	‡13¼
Copper Range	41
Daly West	3
Davis-Daly	5
East Butte	‡19½
Franklin	.3¼
Granby	‡79
Hancock	‡4¼
Hedley	‡12
Helvetia	‡.20
Indiana	.75
Isle Royale	25
Keweenaw	‡1¼
Lake	.3
La Salle	‡22½
Mason Valley	2¼
Mass	4¼
Mayflower	3¼
Michigan	‡2¼
Mohawk	50
New Arcadian	‡1¼
New Cornelia	15¼
New Idria	‡8¼
North Butte	10
North Lake	‡.40
Ojibway	‡1¼
Old Dominion	34
Osceola	‡52
Quincy	‡57
St. Mary's M. L.	‡43
Santa Fe	‡.25
Seneca	14
Shannon	2¼
Shattuck-Ariz.	‡14¼
So. Lake	1¼
So. Utah	‡.14
Superior	‡4¼
Superior & Bost.	2¼
Trinity	2⅞
Tuolumne	.85
U. S. Smelting	45
U. S. Smelting, pf.	46¾
Utah Apex	‡2¼
Utah Con.	7¼
Utah Metal	1¼
Victoria	‡2
Winona	‡.90
Wolverine	17¼

N. Y. CURB†	Feb. 18
Big Ledge	.75
Butte & N. Y.	.50
Butte Detroit	‡.01¼
Caledonia	.29
Calumet & Jerome	⅞
Can. Cop. Corpn	2
Carlisle	‡2
Cashboy	.06
Con. Ariz. Sm.	1⅛
Con. Coppermines	5¼
Goldfield Con.	.20
Goldfield Merger	‡.05¼
Greenmonster	‡⅞
Hecla Min.	4⅞
Howe Sound	‡3¼
Jerome Verde	‡.50
Louisiana	‡⅞
Magma	25
Marsh	‡.03
McKinley-Dar-Sa.	.45
Milford	‡.75
Mother Lode	.29
Nixon Nevada	.36
Ohio Cop.	.50
Rawley	‡2½
Ray Hercules	2¼
Richmond	‡.56
Rochester Mines	.32
St. Joseph Lead	11
Standard S. L.	⅛
Stewart	.16
Success	.5
Tonopah	3¼
Tonopah Ex.	2¼
Tribullion	‡1
Troy Arizona	‡.10
United Eastern	4¼
United Verde Ext.	30
United Zinc	‡1
Utica Mines	‡.08

TORONTO*	Feb. 18
Adanac	.22
Bailey	.03
Beaver Con.	.40
Chambers Ferland	‡.09
Conlagas	2.00
Hargraves	.03
Kerr Lake	‡5.37½
La Rose	.31½
Lake Shore	.90
Min. Corp of Can.	2.00
Nipissing	‡8.75
Peterson Lake	.09
Temiskaming	.34
Wettlaufer-Lor.	.04
Davidson	.55
Dome Exten.	.27
Dome Lake	.20
Hollinger	6.12½
McIntyre	1.62½
Newray	.12½
Porcu. Crown	‡.28
Teck-Hughes	.27
Vipond	.19
West Dome	.15

* Bid prices. † Closing prices. ‡ Last quotations.